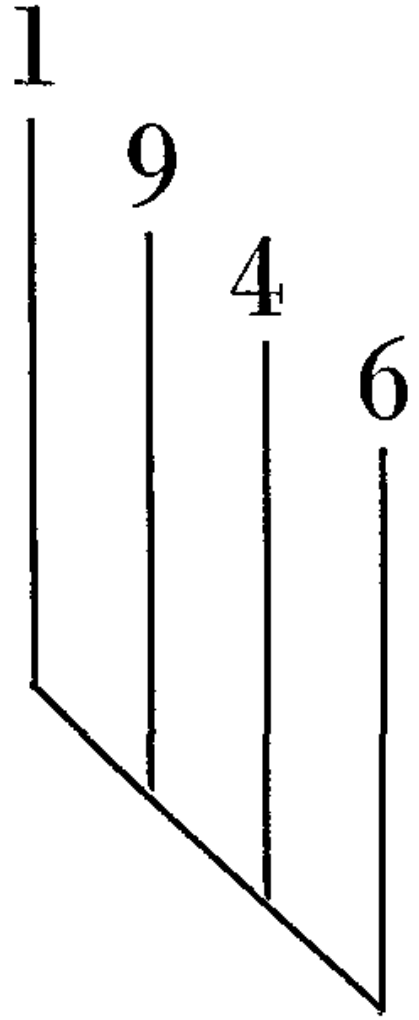
THE BOOK OF KNOWLEDGE

ANNUAL



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The

BOOK OF KNOWLEDGE

The Children's Encyclopedia

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THE BOOK of KNOWLEDGE ANNUAL 1946 is a survey of the most interesting and important events of the year that has passed perhaps the sort of survey you might have made if you could have sat on the moon and watched the earth through a big telescope If you had done that you would surely have noted that one major subject occupied men s attention more *even than war though it was* made to serve the war The subject of course was Science Chief actors in the most spectac ular drama of the year were neutrons pro- tons and electrons—particles that make up atoms the bits of matter Every civilized person on earth was shocked by the atom bomb into realization that a new era had dawned You have seen history s time clock click forward

The keynote of this ANNUAL therefore is Science There are chapters on basic science —articles that explain atoms and molecules atomic energy and radiation There are chap- ters on astronomy, and on new discoveries in chemistry and biology The science books of the year are reviewed and scientific progress in aviation and other industries is reported There are chapters which set forth the scien tific basis of our economic life

Do not be afraid of the word science It comes from the Latin *scire* to know science in its broadest meaning is nothing more nor *less than knowledge*

A wise man once said that the great circle of knowledge is most useful not at its core but at its rim where it touches other knowl edge So it is with modern science If you understand any arc of it you soon find that it sheds l ght upon another arc in the circle It is the editors hope that THE BOOK OF KNOWLEDGE ANNUAL 1946 will *light for* a boy and girl many an arc in the wide circle of Science

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AFRICA

...a continental question mark...

By

Roy Winthrop Hatch

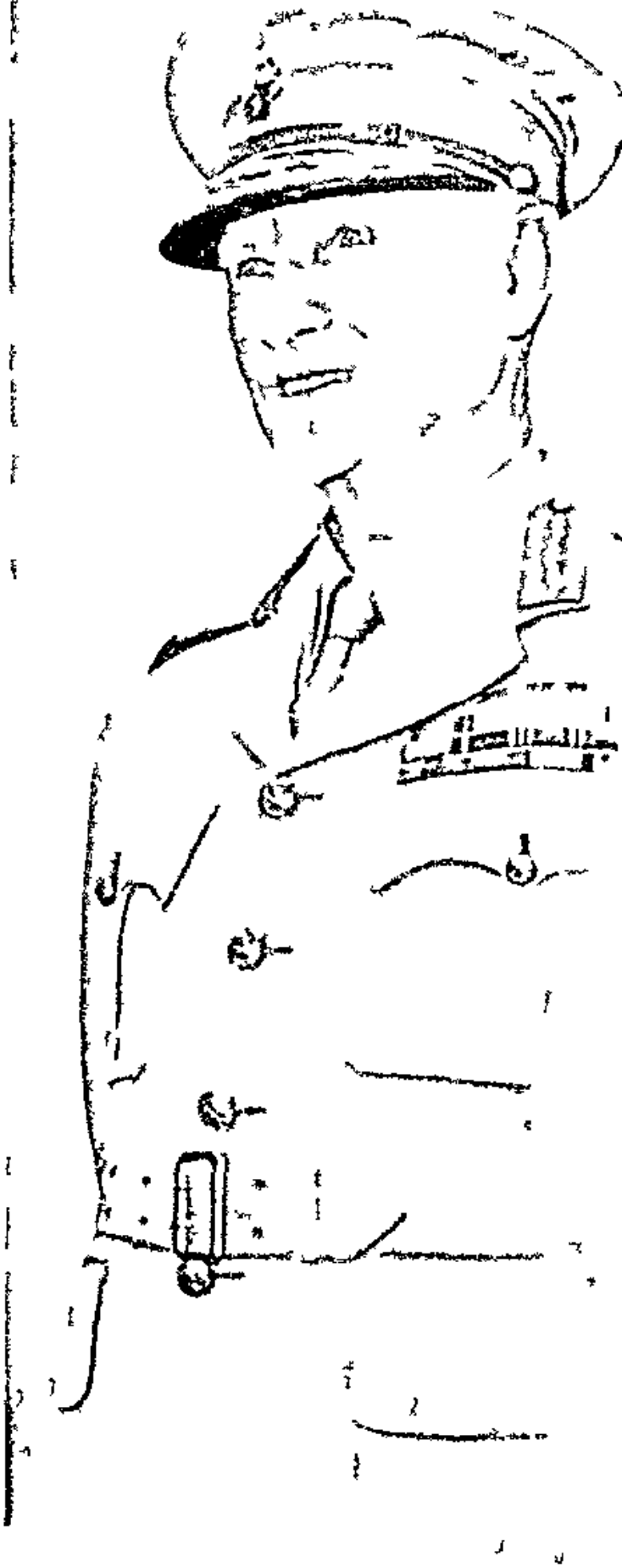
IN the vast continent of Africa there are many Africas with such important differences of peoples and governments that we must speak of them separately

There is North Africa and French West Africa and Egypt and the Sudan There is Ethiopia and French Equatorial Africa and *British East Africa There is the Belgian* Congo and Liberia and British West Africa There is Portuguese West Africa (Angola) and the Union of South Africa And each one of these Africas has its problems

If your father and mother were asked to choose one word to describe the Africa they read about when they were in school they would probably use the adjective of the *great explorer Henry M Stanley who spoke* of darkest Africa Did you ever stop to wonder why Africa was given such a name? Doesn't the sun shine as brightly there as it does in other lands? To be sure it does But when Stanley said darkest Africa he meant that great areas particularly in the interior of the continent were absolutely unknown to us

Today new light has been thrown on this dark continent And many boys in soldiers uniforms have helped to bring this new light They have written home about the places and the people they have seen They have told of strange native customs of new fruits and vegetables they had never eaten before of the wild animals of the tropic jungles the weird beauty of a great desert in the moonlight *the sweep of broad rivers* and the mysterious Mountains of the Moon

In these letters and in the newspapers the moving pictures and over the radio we have gone with the troops from Casablanca to Cairo to Cape Town But all these bits of description that we have pieced together may have given us a picture of Africa rather like a jigsaw puzzle *with important parts missing*



Royal Canadian Air Force photo

Jan Christiaan Smuts, prime minister of South Africa.

of Africans Belgium Spain and Portuga look upon their colonies as permanent posses sions These policies conflict with each other and create many diff culties not only be tween the European powers involve l but more directly with the natives

Of tl e two independent countries in Af rica one is a republic and the other is a kingdom Thanks to air travel the Negro republic of Liberia no longer seems very far away Fisherman s Lake in Liberia is a base of the Pan American Airways The bulge of Brazil is nearer to Fisherman s Lake than it is to Dakar on the African bulge One of the important developments in Liberia in recent years has been the production of rubber which you may read about in The Story of Rubber in this ANNUAL

The only other independent country in Africa is Ethiopia the valiant kingdom of Haile Selassie In 1935 Mussolini s sold ers invaded Ethiop a But with England s a d Ethiopia drove out the Italians in World W ar II and Haile Selassie again sits upon the independent throne of his fathers

In other divisions of Africa there are grave problems of race and color These problems are acute in the Union of South Africa. The natives of South Africa make up 80 per cent of the population but they possess only 8 per cent of the land However some of the white leaders of South Africa such as the venerable Jan Smuts are mindful of the needs of the natives In northern Africa where the Mohammedan religion pre vails the problems of race are not faced for Mohammedans do not believe in making color or race distinctions

AFRICAN BOYS AND GIRLS IN SCHOOL ARE BRIGHT AND QUICK TO LEARN

There is plenty of evidence that African children respond as well to any type of schooling as European children do Mission aries and travelers in Africa have stated that the cultural possibilities of the African na tives are undeniable They have found the African able to profit from a high degree of training and education

The story of the treatment of African natives by the ruling whites is not a pleasant one No issue calls for more immediate remedy than does the ill treatment of the natives by some of the white overlords or bosses

Native Africans form a large supply of cheap labor for many African industries such as m ning—in South Africa—and the rul ber industry of the Congo and the equa



F en h P e s and Inf n a on Se v ce
The Sul an of Morocco decorates a native soldier

torial belt Some of the Africas have im posed taxes known as the Head and Hut taxes The workers have to pay these taxes out of their small wages and this keeps their standard of living very low Unfortunately Europeans have brought tuberculosis and other diseases to Africa These have taken a terrible toll among the natives

However there are leaders, both black and white who see clearly that many of these old problems must find a remedy in the near future Many of these leaders are turning to the schools for help Schools are no v being formed to teach and train young Afri cans so that they may be better and more efficient citizens

One of the leaders in th s hope for a new Africa is Dr Ako Adjer W hen he was a boy Ako Adjer was a member of the Ga tribe of the Gold Coast He came to the United States as a young man and studied law and journalism at Columbia Univers ty Now Dr Adjer is a professor at Fisk a Negro university in Nashville Tennessee He speaks therefore as one who can see both sides of Africa s problems Although Dr Adjer believes that his native land can have a bright future he knows that the Africans themselves must be taught to ach eve it In his own words None of the plans and pol cies we now formulate for post war Af rica will ever succeed until the Africans themselves are trained to assume respons bility for their own destiny

AGRICULTURE and a HEALTHY WORLD

By Robert F and Laura T Griggs

FOR the first time in history it begins to seem possible that all the peoples of the world will be able to get the right quantity of the right food to make them well and strong and happy

Down through the ages great masses of people in one part of the world or another have known the dreadful meaning of starvation The cry of not enough food not enough food has been and still is uttered by vast populations The lack of food kills many and it leaves many more in a weakened condition that greatly cuts down the number of years they can expect to live

Not only is the amount of food important but likewise the kind of food The emphasis on nutritional content—that is the actual chemical value of the food to mans organic system—can not be made strong enough The doors of this subject have just been opened in the last few years We know much more than we used to know about what foods keep people healthy Agriculture by using this knowledge to produce the correct foods will help the worlds billions

In May of 1943 representatives of forty four nations met at Hot Springs Virginia for a Conference on Food and Agriculture Never before in history had so many nations met to consider their peoples welfare Their report carried a clear picture of the worlds need for food The better fed nations were listed as Australia Belgium Britain Canada Germany Holland the United States (except for the southeastern states) the Scandinavian countries and New Zealand

Of the less well fed peoples of the earth the Hot Springs report drew a picture of present needs and desirable changes China s delegate reported It is a conservative estimate to say that half of China never has enough to eat Stark famine is not uncommon and in North China is a regular occurrence

In India 90 per cent of the farm families have poor health due largely to malnutrition (lack of nourishment) and most of the people of India are farmers In these two great countries of three fourths of a billion inhabitants the average length of life is only about thirty six years In the best nourished countries such as Denmark and New Zealand the average person lives nearly twice as long to sixty seven years

In the Philippines under the United States Government 15 000 die every year from the disease of beriberi a disease of the foot nerves even though we know the cure The natives eat almost no vegetables and fruits Of their babies only half as many live



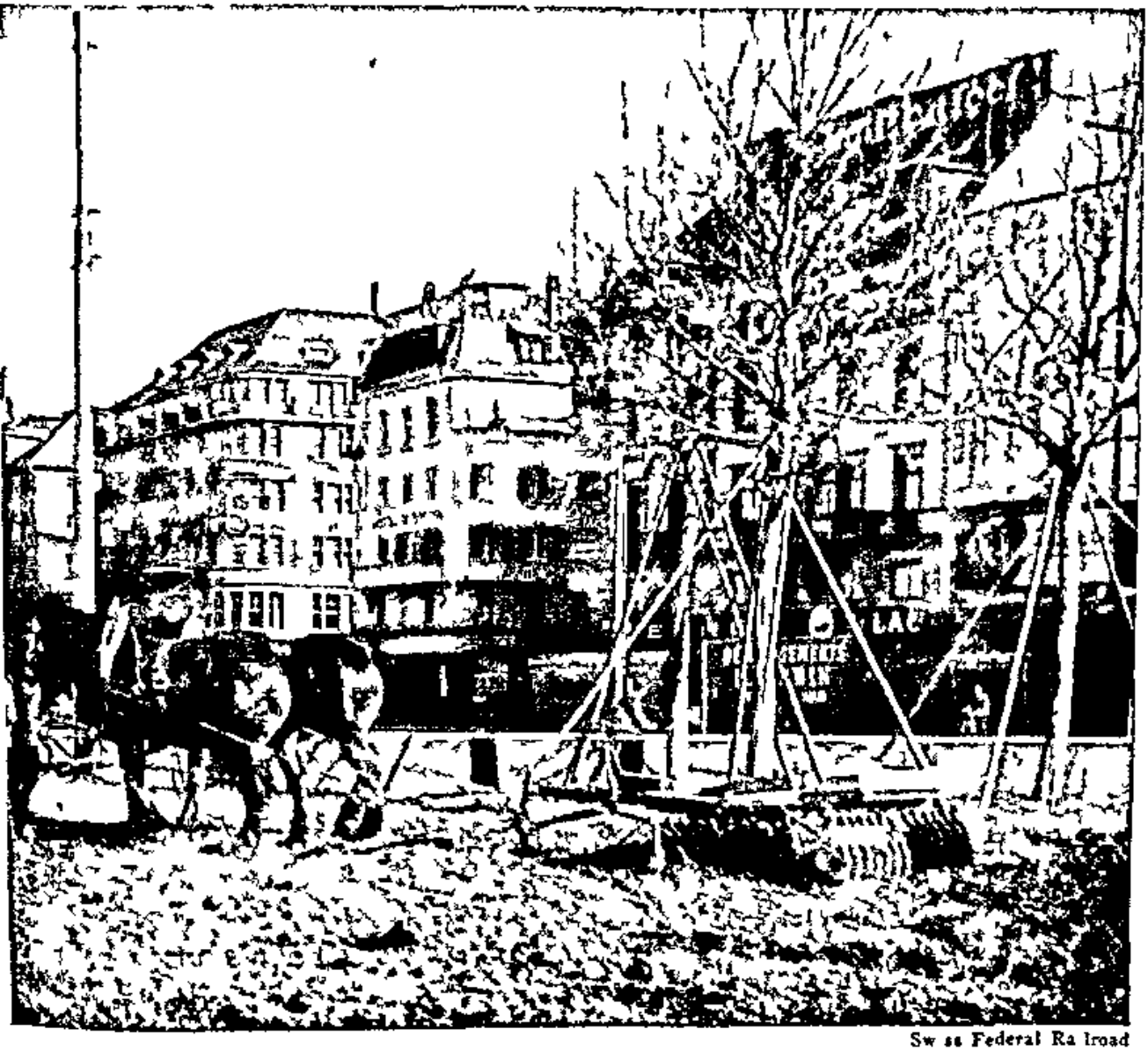
A farm in the heart of Switzerland s largest city

as in America In the countries bordering the Mediterranean severe poverty and mal nutrition are the rule

Careful studies in Britain and the United States have proved that where there is pov erty the people are undernourished When the incomes of the people go up as they have done during the war, the poor buy more pro tective foods, such as milk, meat, etc One of the chief causes of food shortages during the war was the wider spread of prosperity among the people More people could afford to buy better food yet the supply did not rise in pace with the demand

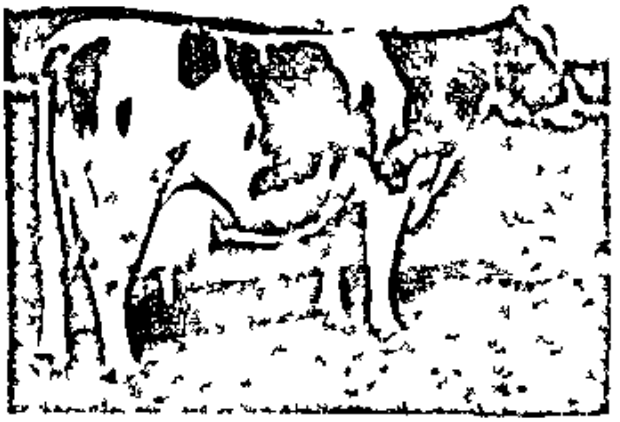
As an effort toward solving the problems of agriculture and food supply in the world, the United Nations Food and Agriculture Organization held its first meeting at Quebec in October Thirty seven countries were rep resented Here a groundwork was laid for co operation among all peoples Further meet ings will take place as planning leads to ac tion The aims of the organization are rais ing world nutrition levels and standards of living improving methods of farming to make the most of land and labor bettering conditions of farm populations expanding world trade

Some people like Thomas Malthus of the last century—a noted political economist and teacher—believe that the populations of the world must necessarily grow faster than food to feed them and that consequently starvation must always be present But Mal thus gloomy prediction of a starving world did not foresee the possibilities of science



Swiss Federal Railroad

As a part of the Swiss agricultural campaign the ground is prepared for planting in Tonhalle Square Zurich.



Carnation Company

Madcap Fayne a champion milk producer points the way toward a plentiful world supply of milk

He could not imagine the results research would bring

He did not dream that a few botanists would patiently breed corn year after year until they had obtained hybrids (cross breeds) which would produce several hundred miles farther north than ever before would yield one fifth more per acre and one third more for the farmer's labor than the best of the older types He could not foresee new varieties of disease resisting wheat and high producing oats that would increase the farmer's yield by bushels and bushels

Breeding of improved strains of animals which is much more difficult than plant breeding naturally lags behind The men of old time however would not have believed possible the improvement which has occurred in the dairy cow The pride of colonial Maryland was Old Five Pints named for her daily milk production Now Madcap Fayne gives her own weight in milk every *two weeks—fifty five quarts a day*

Behind the scenes of increased milk and fat production like this lie many stories such as the one starring the agricultural scientists who work at the Missouri Agricultural Experiment Station The men toiling here noticed that in feeding a cow portions of an iodine compound called thyroxine there was an increase in the milk and fat supplied by the animal Goats were likewise affected However, the price of thyroxine was high Research workers at the station went to work on the problem and found the solution An artificial method of obtaining the substance was developed in which the proteins of skim milk are skillfully combined with iodine This process brought the price down to a point where more dairymen could use the material and thereby increase the productivity of their herds

The common apple too received a production push from the hand of agricultural science Growers of the eastern United States were losing many dollars a year due to the fact that apples were dropping from the trees before they were ripe enough to be sent to market These apples were known as 'bad droppers

The Beltsville Maryland, horticultural station was interested in growth producing substances (*hormones*) and *their effects on* plants Its workers had done much along those lines and had learned to use these hormones skillfully They noticed that some hormone types stopped plant leaves from falling off easily these they tried on fruit with amazing results Apple varieties which had been known as bad droppers remained on the trees long after normal time Orchard yields increased And so by using a simple spray the farmer reaped the reward of a bigger harvest

SCIENCE NOW KNOWS WHICH FOODS ARE NEEDED FOR GOOD HEALTH

Until recently it was supposed that man needed only a few nutrients, fats carbohydrates (bread, sugar etc) proteins (in meats fish eggs etc) and some minerals Today we know that we require many nutrient substances although some in only tiny quantities Because a small group of scientists has worked long years in painstaking research, we now know what foods people must have to be healthy and to resist disease

What are the conditions which have led to the 'newer nutrition ? Widespread diseases which no one knew how to conquer were calling for cures. Take pellagra, for example, in the southern United States Mentally depressed people with horrible sores over their bodies began to appear in large numbers throughout the new mill towns where industries had moved from the North to get cheap labor For many years physicians tried to find the cause of this illness Many wondered if the monotonous diet largely corn pone, could be connected with it Today its cure seems like a miracle One must see it to believe it

A raving maniac suffering from pellagra is brought to the hospital It takes three men to hold him in the ambulance Besides his mental illness he has loathsome sores over his body He is in such a state that his relatives can hope only that he will not linger

long A few milligrams (thousandths of a gram) of a simple chemical compound—nicotinic acid or niacin for short—are injected into his blood stream In seventy two hours he is himself again and his sores have begun to heal

A CURE FOR A DOGS DISEASE PROVIDES THE CLUE TO THE CURE OF PELLAGRA

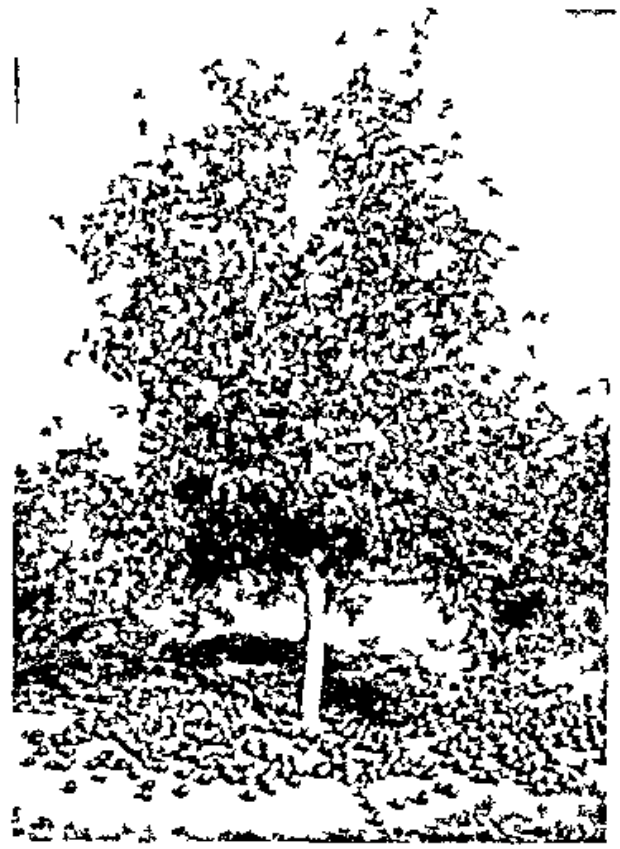
How has this magic cure been brought about when only a few years ago physicians were as helpless to cure pellagra as they now are with cancer? The discovery of a cure for the disease known as black tongue in dogs by C A Elvejhem at the University of Wisconsin led the way It was proved that this *disease is related to pellagra in man* The latter was found to be caused by the lack of a tiny quantity of niacin which would have been supplied if milk lean meat turnip greens or collards had been a part of the regular diet of these people Entirely different then are these deficiency diseases from typhoid fever tuberculosis or malaria which are caused by living parasites that attack their victims

Deficiency diseases have long plagued mankind all over the world One of the chief difficulties Christopher Columbus had to fight on long voyages was scurvy the most prevalent disease in Europe at that time Just a little later Vasco da Gama sailing around the Cape of Good Hope lost nearly two thirds of his crew by this disease Scurvy was found especially among sailors soldiers on campaigns and people in besieged cities People suffering from scurvy develop spongy gums their teeth become loose fall out The walls of their blood vessels break resulting in bleeding within their bodies In the Crimean War more lives were lost from scurvy than in all the bloody battles

Early observers noticed that folks who had plenty of fresh vegetables and citrus fruits did not have scurvy The early New England settlers struggled with this disease and learned to prevent it by eating fruits and sprouted grain One of the benefits some early colonists took back to England was the white potato When it was grown throughout Europe scurvy almost disappeared

In spite of the clue that this disease was connected with what people ate it was 300 years before the exact cause was understood C G King of the University of Pittsburgh discovered the scurvy fighting substance in 1932 and succeeded in making it It is known as vitamin C

The nutritionists are discovering more



Fallen apples The use of a new spray would have kept these apples on the tree until harvest time



Photos Bureau of Plant Industry U S Department of Agriculture

Apples ready for picking Thanks to a spray the fruit did not fall before ripening

about this useful vitamin all the time When taken in four to eight times the amount needed to prevent scurvy it is claimed to produce much better general health and to help avoid such diseases as the common cold pneumonia and even tuberculosis

As serious and widespread in Oriental countries as scurvy was in Europe beriberi took a heavy toll of life in the East About 1880 a high medical officer of the Japanese navy noticed that British sailors in the Pacific did not suffer from this disease which kept almost one half of his men on the sick list every year He decided that the trouble must be with the diet of the Japanese Most Oriental people live largely on rice and white polished rice by choice This officer sent two vessels on long voyages Of the 276 men in the first 169 had beriberi The second ship with a similar crew he sent over the same route but he changed their ration He cut down the rice increased the barley and added meat vegetables and condensed milk Only 14 men had beriberi and each of them had refused to eat all of the new food Because of this experiment the entire Japanese navy diet was changed and beriberi practically disappeared among them

In spite of this successful experiment there were many who felt that the improvement might be due to better sanitation A Dutch physician however working in the East Indies noticed that chickens eating polished rice had an illness similar to beriberi He made careful tests and found that he could produce beriberi in poultry simply by feeding polished rice

RICE HAS A BROWN OUTER COATING THAT CURES BERIBERI

In the Philippines physicians began to experiment along similar lines It was found that beriberi could be introduced by feeding hospital patients polished rice, or cure it by feeding rice with the brown outer coating left on This was indeed a forward step

However, it took twenty five long tireless years before Dr R R Williams succeeded in separating the pure substance that prevented beriberi in working out its complicated chemical formula and in learning to make it synthetically (out of existing materials) This vitamin is called thiamin It occurs in small quantities in many common foods, though richest in meats especially pork, whole grains and beans

It was Dr Russell M Wilder and others of the Mayo Clinic who proved by experiment that without thiamin in their diet human beings lose their will to work become uncooperative irritable, quarrelsome When thiamin is restored to their food they become well and normal within a short time It has been suggested that thiamin was the best secret weapon that Hitler had The lack of this vitamin cuts the peoples will to resist Just how far he robbed the many occupied countries of thiamin is not fully known, but we do know that one of the first things the Germans did when they overran Belgium was to steal almost all the yeast that being one of the best sources of thiamin and other related B vitamins

A FAMOUS BREAKFAST THAT MADE CHILDREN GROW TALLER

In the search for a better understanding of nutrition many special experiments in feeding have been carried out In Norway where some school children were given an extra meal the average height of fourteen year-olds was increased by four inches The Oslo breakfast as this experimental meal was called consisted of milk, orange, whole wheat bread, rye biscuit, cheese, carrot and cod liver oil

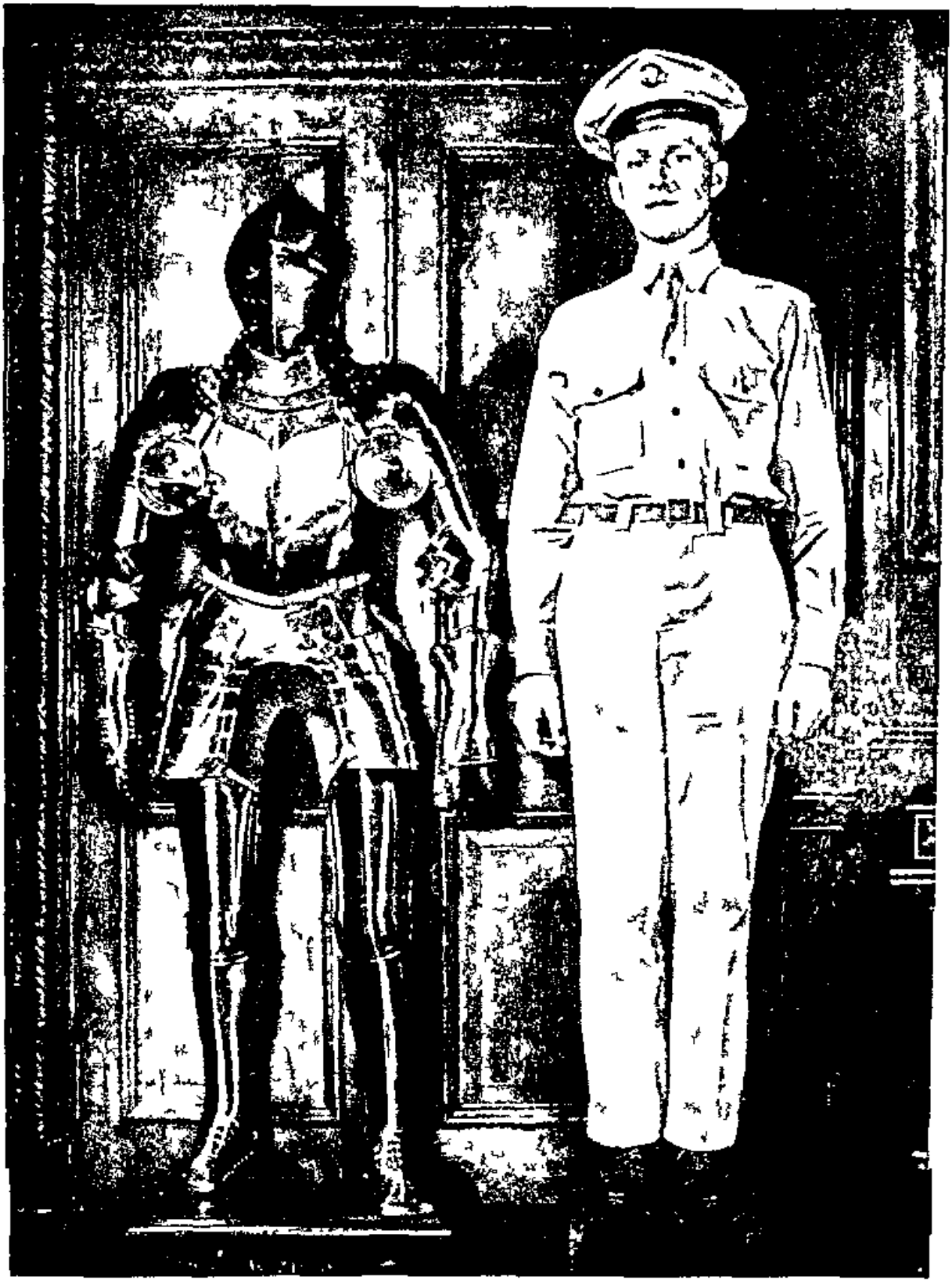
Throughout countries where nutrition has been improving in the last 200 years the size of the young men has been steadily increasing Military records prove this American soldiers in World War II averaged a full inch and a half taller than their fathers in the first World War The American soldier of today could not possibly have gotten into the armor of the sixteenth-century warriors Perhaps they were not such enormous giants in those days as we imagine from the old stories

MODERN ARMIES UNDERSTAND THE VALUE OF A GOOD DIET

Modern armies have spared nothing in providing the best possible nutrition for their men The German Government saw to it that the working people as well as the soldiers were well fed It subsidized milk vegetables and potatoes so that the poor could afford a good diet That is the Government paid part of the cost of production to the farmer so that the price remained within the reach of all

British nutritionists were quick to see the need of providing a healthy diet for all their people during the war They advised their government likewise to subsidize the protective foods, holding them at a price the poorest could afford In spite of the blitz and the loss of ships by submarines, they maintained

WARRIORS ARE GROWING TALLER



N na Leen P x

Knights of old were pretty short fellows judged by modern standards. This suit of armor was tailored to fit a knight of the sixteenth century The sold er towering above it is an ave age American recruit 5 feet 8.4 in hes tall Scientists tell us that *improved d ets have helped to bring about a steadily increas ng average height.* In a little over fifty years in the Netherlands recruits averaged a gain of five inches



Photo by Arthur Rothstein Courtesy American Red Cross

Like countless other children this youngster in the Philippines needs her Red Cross gift of food

the health of their people There were no epidemics such as that of influenza during World War I Most remarkable of all the people on the average were better fed than in peacetime Without such provision it is doubtful that Britain could have held out Commenting on Britain's war food policy Sir John Boyd Orr newly chosen director general of the United Nations Food and Agriculture Organization said 'We have examined the food position on the assumption that the object of the war policy is to provide the whole population with a diet adequate for health It is to be regretted that we did not have such a policy in pre war days when food was actually or potentially so abundant that measures were taken to restrict the national supply'

We now know that the lack of proper food may be largely responsible for epidemics It has been proved by experiment that protection to the body from infectious diseases is chiefly provided by plenty of protein in the diet Proteins as we have seen are supplied especially by meat fish eggs cheese and beans though small amounts are contained in most foods The British by providing their people with a bread which retained most of the original nutrients of wheat, by giving priority to milk cows over beef cattle and by greatly increased planting of potatoes saved their peoples health in spite of the war A larger proportion of the babies lived than ever before In Scotland the reduction in infant deaths was 20 per cent

The first act of the United States War Food Administration was to require the enrichment of all bread according to the formula recommended by the Food and Nutrition Board Nearly half of the states to date have passed laws making the enrichment of bread permanent and requiring also the enrichment of flour Several of the southern states have passed similar laws requiring the enrichment of corn meal If enrichment were universal pellagra would be wiped out entirely

As a result of advances in the arts of agriculture the United States broke all records for food production in each of the years beginning with 1937 and continuing through the war Each year a bigger crop was harvested than ever before and this record breaking was an important element in the victory over Germany and Japan

These feats were accomplished in spite of serious shortages of man power and machinery The meaning for the future is plain When the boys are all home from the service and when new and improved machinery is readily available again American food production will go on to dizzy heights and new records

MANY FACTORS WILL HELP TO GIVE US BETTER AND MORE PLENTIFUL FOOD

We are promised by the experts that before 1950 the United States and Canada will be faced with the problem of gigantic food surpluses Progress in science will make sure that this food is in the truest sense better than ever before Agriculture will then face a battle royal in marketing these products

The average buyer in Chicago on Thursday will have his choice of oranges picked on Wednesday in California or Florida Plant ripened Texas strawberries will be hardly more than a day from any place in the United States as air transport whittles the farmer to-consumer time

A fast growing industrial child is the quick freezing operation It opens vast fields to agriculture As the change-over from war time to peacetime manufacturing permits industry may approach its goal of placing a quick freeze unit in every home that now has a refrigerator Cold storage locker operators and frozen food stores plan delivery to the home on a weekly schedule The housewife will be able to plan her meals a week ahead regardless of season or weather Complete pre-cooked pre-cut and pre-packaged meals

further brighten the prospects

Rosy as this picture seems there is a cloud on the horizon Generations hence people will find it hard to believe that some of their ancestors of the 1930s and the 1940s suffered dire distress from lack of food while others could not sell the food they raised Right now in spite of surpluses that face agriculture in the United States and Canada there is still the threat of famine in other portions of the earth

The Hot Springs Conference of the United Nations estimated that almost twice as much food as the world produces at present is needed to feed the world properly This is a tremendous order Can it be done?

The conference report suggests how it can be done Most of the methods it lists are not new Rather they recommend going further on what has already proved successful (1) more of modern agricultural machinery with credit made more easily available so that farmers can buy what they need (2) more lands to be brought under cultivation (3) better breeds of cattle (4) better seed for crops (5) more and better soil conservation to prevent the wasting away of our lands (6) larger livestock production (7) larger production near population centers of perishable protective crops such as vegetables fruits milk eggs and meat

WORKING TOGETHER NATIONS CAN ASSURE A FAIR RETURN FOR THE FARMER

This world wide program the conference points out can succeed only if nations work together the more fortunate countries making loans and giving technical assistance to those less developed Only by international trade on a greater scale than ever before with a fair return for the farmer can the plan succeed Success in such an undertaking would solve the problem of the farmer and as the farmer prospers so prospers the whole nation

One part of the plan is comparatively new that of shifting farming more toward food production A good example would be growing less cotton in the undernourished southeastern United States and more protective foods

Denmark successfully made such a change years ago When Britain stopped buying Danish wheat in order to favor the Canadian farmers Denmark was left in real distress With courage and vision the Danes then entered a help-one another way of life (co-operative system) that saw them raise hogs and poultry of the highest quality A little country without any great natural resources such as forests coal or minerals yet she has solved the problem of living Her people as a whole are now better fed have better medical care and are better educated than any other country in the world except neighboring Scandinavian countries

SHOULD AMERICAN AND CANADIAN FARMERS PLAN TO PRODUCE FOR EXPORT?

American and Canadian farmers today are enjoying a living standard well above that of former years Farm income is higher than ever This is chiefly because agriculture in these countries is producing for export as well as for home consumption And in the words of Dr G S H Barton deputy minister of the Canadian Department of Agriculture if farmers do not continue to plan production for export to give the overseas buyer what he wants then the farm standard of living can not help but decline

The solution of agriculture s difficulties lies in supplying food to all the people who need it But the process is a vast and complicated one The experience of the past shows that the mad rush of nations to become self sufficient and to maintain high tax walls between themselves and the rest of the world destroys their export trade This must not happen again

If the United Nations set themselves to the great task of finding ways and means to feed all the peoples of the earth the good which can result could not be measured This alone would go a long way toward abolishing war For just as long as great populations are hungry there can be no stable peace

The practical effect of feeding all peoples would be as much a help to agriculture as to the hungry With a reasonable return to the farmer and with a fair adjustment between industry and agriculture such a program of increased food production would spell prosperity for all people

President of the United States Harry S Truman in an address to the United Nations Food and Agriculture Organization meeting at Quebec said that this was an organization dedicated to achieving two ambitions through common effort and sacrifice— First that people in all parts of the world can and should have plenty of food and of other products of the farm and second that the world s people who draw wealth from the earth and sea can and should enjoy their fair share of the good things of life

These are high goals the challenge faces world agriculture and world government



An ordinary photograph of the label in the corner of Carpaccio painting in the museum

ART



An infrared photograph of the same label. The signature is under the surface of the paint.

Science Looks at Paintings

By Murray Pease, *Associate Curator*

Department of Conservation and Technical Research The Metropolitan Museum of Art

MANY wise books have been written to explain how artists paint pictures and how we ought to look at them If we could read all of them we might become very learned indeed on the subject of art But all we really need to remember is that artists love to paint pictures and want us to enjoy them This will always be the truest and best reason for looking at paintings Most people need no other reason

But for some of us there are special reasons for looking at paintings and special ways of doing so In art museums there are many paintings some of them hundreds of years old Museums must preserve these and the others not yet so old so that they will exist and give pleasure perhaps hundreds of years from now To do this those who work in museums must know just how the paintings were made and of course must find it out without damaging them in any way Much can be found out by reading old books and records The museum workers can find out even more by studying the paintings themselves very carefully—studying them, for the time being not as beautiful paintings, but as things which have been built from wood and canvas and glue and paint just as chairs or tables are built The more they find out about the materials of paintings and how the artists put them together the better they will know how to take care of them—and the more they will admire them too, because good paintings have beauty of fine workmanship as well as beauty of color and design

In all this the museum workers are rather like doctors who also must examine their patients before they can try to take care of them Many of the special instruments that doctors use are helpful in examining paintings One of the most useful is the microscope This can make tiny details of brush work appear large enough to be compared with similar parts of other paintings It can show us old damages, perhaps so skillfully repaired that they might otherwise be overlooked It also makes it possible for us to take samples of the paint so small that you could not see them or tell where they came from without a magnifying glass and analyze them chemically to find out what kind of paint the artist used

But we may also want to find out about the layers in a painting that are underneath the paint surface where they can not be seen with the eye or the microscope There are two usual ways of exploring these hidden parts without damaging the painting One is by infrared photography the other is by X rays Both of these methods use invisible rays or waves or radiations Although we can not see them these rays are in many ways quite like visible light For example, they can be used to make pictures on photographic film They are different from light in being able to pass through many materials that light will not pass through So by using these properties in combination, we can make real photographs of inner parts of paintings just as doctors can take X ray pictures of internal parts of human beings

Each of these methods has its own special uses Infrared rays although they will travel farther through solid or opaque materials than ordinary light are still far less penetrating than X rays So infrared rays are what we use when we want to see just a little way down below the surface of a painting Why should we want to do this? There are several reasons why we might One is to find out whether the artist changed his mind while painting and perhaps covered up parts already begun Being unfinished these parts, if we could see them, would tell us quite a lot about the artist's methods We might perhaps hope to discover something that would add to our knowledge of the painting's history

At the top of this page are two kinds of photographs of a small place in one corner of a painting This strange place looks as if it ought to have some writing on it But when you look at it, there is almost

HOW TINTORETTO CHANGED HIS PAINTING



All p c u es courtesy Met opol tan Museum of Art

This is how the painting of the Doge Alvise Mocenigo Presented to the Redeemer would appear to us if we stood before it at the Metropolitan Museum of Art. The areas photographed by infrared and by X rays are marked by white lines and are shown below. Experts suspected that originally another figure was here



This X ray shadowgraph of an apparently empty space shows the figure of a man believed to be St. Mark. The cross shaped area is the shadow of the stretcher that supports the canvas.



Infrared rays bring out the figure of an angel hovering over the Doge. The painter evidently changed his mind about the p cture's composition

nothing to be seen, as the ordinary photograph shows The infrared photograph, however, tells a different story It shows very clearly indeed that there is writing there, buried below the surface of the paint It is the signature of the artist who painted the picture more than four hundred years ago How or why it was covered up, we can only guess, but now at least we know it is there It is in Latin, and means "The Work of Vittore Carpaccio of Venice" Vittore Carpaccio was a painter who lived in Venice at the beginning of the sixteenth century

MUSEUM WORKERS THOUGHT IT STRANGE THAT ST MARK WAS NOT IN THE PICTURE

On page 23 you will find an illustration of a well-known painting by another great Venetian artist Tintoretto It is an imaginary scene in which a famous Doge (chief magistrate) of Venice is being presented to the Redeemer by four saints It is a partly finished study for a larger painting It has always seemed surprising that St Mark who is the patron saint of Venice, was not in the picture, especially since his symbol, the lion, can be seen in the shadows But now look at the picture of the infrared photograph of the empty space to the left of the Doge Here are shadowy traces of one or more figures that are not to be seen on the surface This helps us to guess that Tintoretto began his design with other figures, probably St. Mark and an angel, in this space, and then, deciding that it made a poor composition, painted them over Because this had already been suspected for other reasons, a small part of the over paint has been removed from the head of the upper figure, showing part of a face just sketched in It is near the upper right hand corner, and looks as if it might have been planned to be a hovering angel

X RAYS OR "SHADOWGRAPHS" DO NOT SHOW TONES OR COLORS OF PAINT

Between infrared photographs and X ray pictures there is an important difference As you can see, infrared photographs look quite like ordinary ones—both of them show the colors of the paint, changed into black and white But X ray pictures (which are usually called "radiographs" or 'shadowgraphs') do not show the colors or tones of the paint at all To understand this we must know how they are made To make a radiograph, the rays from the X ray tube pass through the painting and strike a sheet of photographic film which is placed on the other side On their way through, some of the rays are stopped by the thicker paint, especially if it contains metal compounds such as white lead (white lead is one of the commonest of white pigments, it was used in almost all old paintings) The rays that are stopped do not reach the film, and so parts of it are not exposed, while others are When we develop the film, therefore, we can see a pattern of shadows, which are the shadows of the paint itself Of course, it makes no difference whether the paint is on the surface or not wherever it is, it will cast its shadow on the film It is true that radiographs often look quite like the paintings from which they are made But this is only because we usually study the X-ray negatives, without bothering to make prints from them In the negative the shadows are light instead of dark, and so they look like the white paint that made them

THE SHADOWGRAPH REVEALED THE FIGURE OF A MAN INVISIBLE TO OUR EYES

One picture on page 23 is an X ray shadowgraph of a part of the same painting by Tintoretto It includes the part near the Doge's head, where we might expect to find the figure of St Mark if our guess was correct If you look at it for a while, you will see the upper part of a man, seen from the back He carries a great book under his left arm, and leans to the right, toward the figure of the Doge We can now be quite sure that this was intended to be St Mark, with the book of his Gospel and with his lion at his feet The pale cross-shaped area is the shadow of the wooden stretcher that supports the canvas The small black spots that you can see here and there are holes in the paint

OUR EYES AND OUR MINDS THE BEST INSTRUMENTS FOR STUDYING PAINTINGS

What do we really learn from such photographs as these? Not very much, perhaps but when we add this information to all that we have discovered by other means, we *may* find that we have learned a great deal At times these "scientific" methods will not help us, for most paintings have no hidden secrets, and all the X rays and infrared photographs in the world will tell us no more about them than a sensible use of our eyes In fact our eyes and our minds will always be the best 'instruments" for looking at paintings—or at anything else We must learn to use them wisely and thoughtfully, and then we shall be able to use other instruments in the same way



Boe ng A rcraft Co \eme U S Na y pho og aph

General MacArthur and President Osmena rejoice over the liberation of the Philippines won by land sea and air

ASIA and the PACIFIC AREAS

By H R Ekins

THE year 1945 saw the destruction of the vast empire that Japan had built up in Asia In the early months of the year the Japanese suffered a series of disastrous defeats British Empire troops conquered Burma after a difficult campaign in dense jungle country Australians invaded the huge island of Borneo American forces drove the Japanese from one outpost after another in the Philippine Islands they captured Iwo Island and invaded Okinawa in the Ryukyu group Japan s once mighty navy was reduced to a few battered ships American bombing planes kept pounding away at the Japanese homeland and they caused terrible damage

By V E Day, the day of victory in Europe (May 8 1945) Japan was already a beaten country She faced redoubled attacks by the United States and Great Britain who were now free to direct against Japan the armies that had been used against the Germans In the months that followed Ameri*can bombers kept up their raids on the Japa*nese home islands while the Americans and British gathered their armies for the final attack.

On August 5 1945 the United States launched a terrible new weapon against the Japanese An American Superfortress dropped a single atomic bomb upon the city of Hiroshima The explosion caused by the smashing of atoms brought about fearful damage An area of over four square miles was flattened out more than 100 000 persons lost their lives

August 8 1945 was a black day in Japanese history On that day another atomic bomb was dropped this time on Nagasaki On that day too Russia declared war on Japan and at once attacked the Japanese positions in Manchuria or Manchukuo The Japanese now realized that further resistance was useless On August 10 they offered to surrender they asked only that their emperor should be left on the throne of Japan

The Allies agreed to let the Emperor remain But they made it clear that this monarch was to be a mere puppet acting under the orders of the Allied supreme commander On August 14 the Japanese accepted these terms The official surrender took place on the deck of the battleship Missouri in Tokyo Bay on September 1, 1945 (our time) Since this corresponded to September 2 Tokyo *time September 2 was hailed as V J Day* the day of final victory over Japan It also marked the end of World War II the most destructive in the history of mankind

The end of the war did not bring peace to Asia In the regions freed from Japan there was want and misery as the result of years of brutal Japanese occupation There was great unrest too in many of the occupied

areas In part this unrest had been stirred up by the Japanese They had done their best to turn the peoples of the Netherlands East Indies French Indo China and the British possessions of Malaya and Burma against their former white masters The Japanese had promised to build up a Greater East Asia Co prosperity Sphere in which all native peoples would live happily under Japanese leadership

In the course of time these peoples had found out that the Japanese were hard taskmasters who were interested only in adding to their own power and wealth But the Japanese had succeeded in bringing to a head a movement that had been gaining ground for years It reflected the desire of the peoples of Asia to be their own masters it was summed up by the cry of Asia for the Asiatics

This movement had been particularly strong in India where nationalist groups had been demanding independence long before the outbreak of World War II With the coming of peace the demand for political freedom grew more insistent not only in India but wherever the powers of Europe ruled over Asiatics

Elsewhere in Asia too the year 1945 was marked by turmoil There was civil war in China revolution in Iran open combat in Syria and Lebanon rioting in Palestine In the pages that follow we shall tell you about these developments and about other important happenings of the year in the vast Asiatic continent

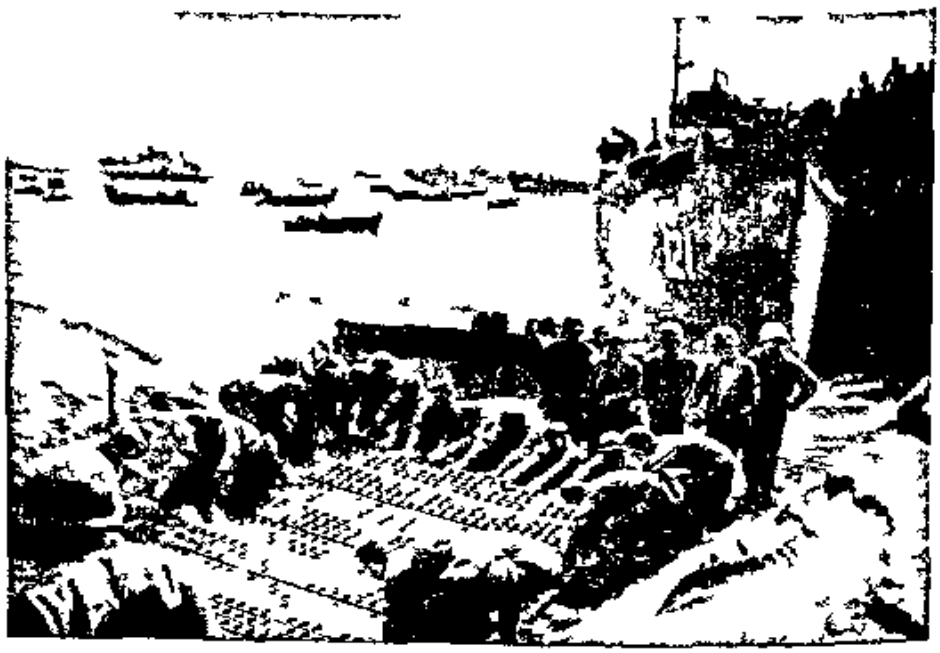
We shall begin our survey with the eastern outposts of Asia those numberless islands which dot the immense Pacific Ocean and to which we give the name of Oceania A great many of the islands were wrested from the Japanese in the course of the war Among these were the groups of the Solomons the Bismarcks the Gilberts the Carolines the Marshalls the Marianas and the Halmaheras Some of these islands had been conquered by the Japanese in 1941 and 1942 Others had been under Japanese rule before the war

What will become of these islands? Some are now governed again by their former rulers—Great Britain the United States and the Commonwealth of Australia The fate of the others must await the decision of the Trusteeship Council of the United Nations Organization (See the United Nations) A number of the islands will probably become American military and naval bases under trusteeships awarded by the United Nations Organization

In some of the islands of Oceania life will return to the old ways of peace In others there will be new developments The islands on the air routes between the United States and Asia will flourish as stopping places for travelers as tourist resorts and as bases with permanent military and naval installations

We now come to the Philippine Islands which are separated from the Asiatic continent by the broad South China Sea To many native peoples the coming of the Japanese meant merely a change of masters to the Filipinos it was a tragic blow

The Philippines had once belonged to



Signal Corps photo

Anti aircraft artillery men lay steel matting on the beach of Iwo Jima so that guns and other equipment can be rolled off the ships



U S Marine Corps photo

The natives of an Okinawa village trudge over stony ground in bare feet, apparently without discomfort. Almost all wear kimonas but without the famous sash of Japanese women

Spain they had been taken over by the United States after the Spanish American War of 1898 Under American rule the Filipinos enjoyed the benefits of education extensive health programs and training in self government In 1934 the United States Congress passed the Tydings McDuffie Act which gave increased political power to the Filipinos it also provided that the islands were to become independent by July 4 1946 The Filipinos had their own president and vice-president their own congress They looked forward confidently to the day of complete independence

The Japanese invasion dashed their hopes In the dark days of 1941 42 when Japanese troops overran the islands the great majority of the Filipinos remained loyal to the United States President Manuel L Quezón and Vice President Sergio Osmena escaped to the United States where they set up a Filipino government in exile In the islands groups of Filipino guerrillas co-operating with Americans kept up the fight against Japan after all organized resistance on the islands had come to an end

The Japanese promised to include the Filipinos in their Greater East Asia Co prosperity Sphere they even set up a puppet republic under Jose P Laurel But they made it clear that they were the real masters and they aroused the fierce hostility of the proud Filipinos When the Americans invaded the islands in October 1944 their task was greatly lightened by the co-operation of the inhabitants As a result the reoccupation of the islands went on rapidly

The Americans did not treat the Filipinos like a conquered people but like faithful and trusted allies In February, 1945 General of the Army Douglas MacArthur leader of the American forces turned over the civil government of the islands to the Filipinos themselves President Quezon had died in August 1944 and had been succeeded by Vice President Osmena Under Osmena the Filipinos set to work to rebuild their land

It was a heart breaking task The Japanese had ravaged fine cities like Manila Baguio Cebu and Iloilo they had burned hundreds of villages They had laid waste the sugar-cane plantations in many areas and had destroyed the machinery used in refining sugar It was necessary to find food and shelter for the victims of Japanese oppression It was necessary to restore Filipino industry and in particular the all important sugar industry

Yet the Filipinos were hopeful They had the aid of their good friends the Americans who provided money relief supplies goods and helpful suggestions The Filipinos planned to elect a new congress early in 1946 the year set for their independence They are looking forward to an era of peace and prosperity as members of the United Nations Organization

North of the Philippines lies Japan now stripped of her conquests and her power She is the chief victim of the war that she had brought on so hopefully Although the Japanese home islands were not invaded until after the final surrender, the chief cities and towns of Japan were laid waste by bombing from the air and shelling from the sea There are not nearly enough homes in Japan there is not nearly enough food It seems certain that many Japanese will die of malnutrition exposure and disease and that a generation of Japanese children will grow up weakened by privations and hardships

The Emperor still rules in name at least



Boeing Aircraft Company
The B-29 Superfortress

but he has no power He must obey the orders of the supreme Allied commander General of the Army Douglas MacArthur who has a strong occupation force of American soldiers to back up his commands At first the occupation of Japan was an American affair Other countries were represented on a Far Eastern Advisory Commission which would make recommendations concerning the Japanese problem but General MacArthur made all the decisions He followed a directive (statement of policy) issued by President Truman on September 6 1945 outlining these policies

On December 27 1945 an important announcement was made by the Moscow Conference of Foreign Ministers representing the United States Great Britain and Russia. It was revealed that an agreement had been reached to set up a four man Allied Council for Japan The American representative would be the supreme Allied commander in Japan he would be the permanent chairman Russia and China would also be represented on the Council a fourth member would speak for the United Kingdom Australia and New Zealand The supreme Allied commander would still have great power But in certain important matters no decision could be reached without the unanimous approval of the Council

In 1945 all the important decisions were made by General MacArthur who followed the President's directive The General has won great admiration for his work in uprooting Japanese militarism He has taken away from the Japanese the guns warships airplanes and munitions factories which served them in their campaign of terrorism in the Far East He has done away with the Japanese Imperial General Staff He has seized the banks which financed Japan's military activities He has caused the arrest of a number of Japanese war criminals—that is men guilty of planning or carrying out the attack on the Allies or guilty of crimes against humanity in the course of the war

He has taken other steps to bring about changes in the Japanese way of life He has demanded that free elections should be held that Japanese women should be granted the vote that labor unions should be encouraged He has insisted that all Japanese must have freedom of speech he has abolished the dreaded secret police He has forbidden the teaching of militaristic doctrines

The atomic bomb left nothing but rubble and twisted metal to show that people once lived in this part of Hiroshima.
Acme



We have told the Japanese that defeat in war has brought them the opportunity to win the benefits of true democracy But democracy is a new and strange word to this people Only time can tell whether the Japanese will benefit by the new freedom At present they are stunned by defeat and in their hearts they are bitter As time goes on however they may turn from the old ways of unthinking nationalism and brutal militarism They may enter upon a new path of peace and co operation with the nations of the world Such at least is the earnest hope of their conquerors

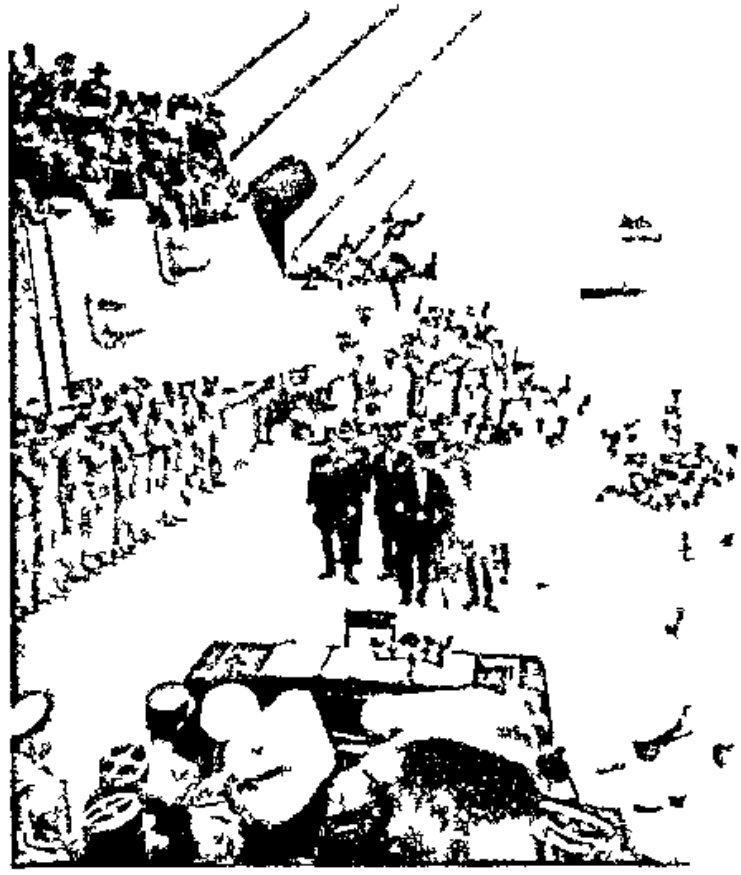
With the defeat of Japan Korea was freed at last from the Japanese yoke Korea a country on the Asiatic mainland was annexed to Japan in 1910 but Korean patriots never gave up the fight for their lost liberty When President Roosevelt Prime Minister Churchill and Generalissimo Chiang Kai shek met at Cairo Egypt in December 1943 they promised that in due course Korea would again be free

The downfall of Japan did not bring independence to the Koreans Their country became an occupied territory with American troops in the south and Russians in the north In December the Moscow Conference of Foreign Ministers proposed a five year trusteeship plan under the United Nations Organization for Korea The Koreans rioted when they heard about this proposal they demanded immediate independence

NEW PROSPERITY FOR ASIATIC RUSSIA

Japan s neighbor to the north is Russia which is very definitely an Asiatic power as well as a European one Asiatic Russia has benefited greatly by the war In the course of the German invasion which began in June 1941 Russia lost some of her most prosperous industrial agricultural and mining areas in eastern Europe To replace these she set up new centers of industry and agriculture in the Asiatic lands beyond the Ural Mountains As a result of these developments Asiatic Russia blessed with almost boundless natural resources, has entered upon a period of great prosperity

There is no prosperity, alas in the ancient land of China Those of us who have lived in China have known for a long time that the end of the war against Japan would mean the continuation of the revolution which began in the year 1911 The original revolution shook off the rule of China s Manchu emperors and brought a republic to the



U S Navy photograph

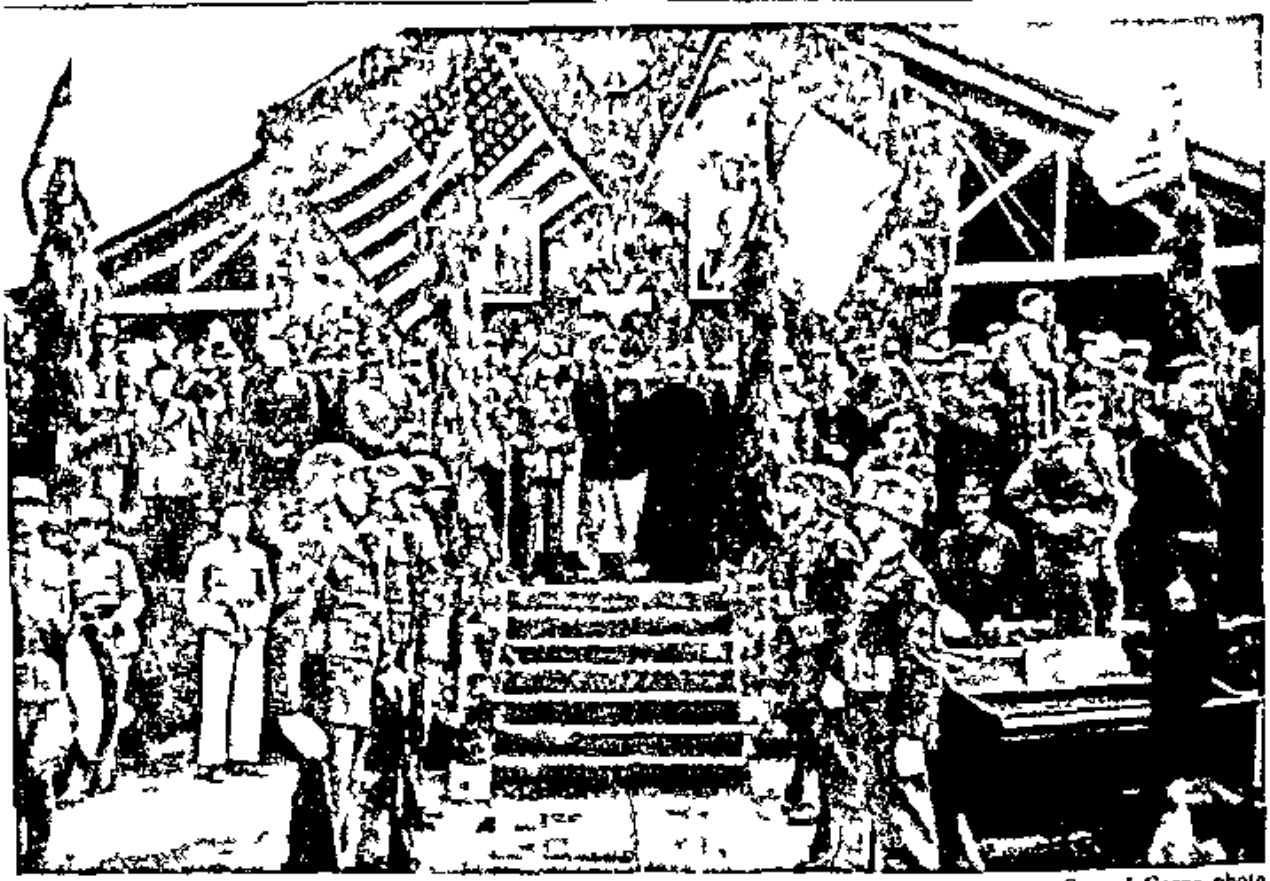
Japan surrenders formally aboard the U S S Missouri

Chinese But unfortunately it did not bring peace When a strong man called Yuan Shih kai took over the presidency in 1912 he aroused the suspicion and then the hostility of many of the revolutionaries

Civil war broke out in China and for years there was almost continuous fighting now in one area now in another Different provincial rulers called *tuchuns,* or war lords raised armies of their own They fought among themselves frequently changed sides, sold their support to the highest bidder and sometimes played the game of foreigners

In the late 1920 s China seemed about to regain her unity under the Kuomintang a nationalist party that aimed to restore China to the Chinese The leader of the Kuomintang Chiang Kai shek was a military genius he succeeded in overcoming many of the war lords and in setting up a fairly strong central government Unfortunately there was trouble from several quarters Japan in 1931 invaded the Chinese province of Manchuria and thereafter kept biting off chunks of northern China There was trouble also with the Chinese Communists who declared that the Kuomintang did not represent the interests of the Chinese people

When open war with Japan broke out in 1937 common hatred of the foe brought together the central (Kuomintang) govern



Signal Corps photo

Chinese and Americans celebrate the arrival in Kunming of the first convoy over the Stilwell Road from Ledo.

ment and the Communists for a time But this patriotic alliance did not last very long In the terrible days when the Japanese thrust deeper and deeper into China the central government and the Communists drifted further apart The Communists gov erned vast areas independently they had their own laws currency and postage stamps they raised and equipped their own armies in defiance of the central government The two hostile groups often came to blows

Russia had been accused of giving aid secretly to the Chinese Communists Many people were surprised therefore when she signed a treaty of friendship and alliance with the central government on August 14, 1945—the day when the war against Japan was brought to its close For a time it seemed that the Kuomintang and the Com munists would bury the hatchet The Com munist chief Mao Tze tung arrived in Chungking, capital of the central govern ment, for a series of conferences which it was hoped would bring about peace in China But nothing came of these meetings

Even while these talks were going on, there was a race between the central gov ernment and the Communists to take over the areas which the Japanese were abandon ing Open fighting broke out between the two Chinese groups in many areas American armed forces found themselves involved in some of these conflicts They co-operated with the central government in disarming the Japanese thousands of Chinese govern ment troops were transported in American planes to the areas which the Japanese had given up

In 1945 China had at least the satisfaction of regaining a vast region that had been lost to her for almost fifteen years because of Japanese aggression—the province of Manchuria The Japanese had set up a pup pet state, called Manchukuo, in this area Strong Japanese forces were stationed here throughout the war

When the Russians declared war on Japan on August 8, 1945, their troops invaded Manchuria and overran the region in a few days Since Russia had been vitally inter ested in Manchuria for a long time, few people expected that the Red Army would give up its hold on the province But it did so and there was considerable fighting be tween the government troops and the Com munists as each group sought to take ove the province Before the end of the year, the central government had won the upper hand

over the Communists in this disputed area

China also regained the territory of Kwangchowan in the southeast This territory had been leased to the French in 1899 for a period of ninety nine years On August 18 1945 the French agreed to give up all claims to Kwangchowan The Chinese hoped also to take over Hong Kong which had been a British crown colony for many years and had been captured by the Japanese in December, 1941 But the British announced that they had no intention of giving up Hong Kong and the Chinese allowed them to reoccupy the colony

As 1945 came to an end there was renewed hope that the central government and the Communists would come to terms President Truman sent General of the Army George C Marshall former American chief of staff to China as ambassador in order to try to bring the two warring factions together As they both hailed the selection of General Marshall it was hoped that he would be able to bring peace to the land

There was grim fighting in southeastern Asia after the end of the war The natives of the densely populated and fertile Netherlands East Indies staged a full scale revolt against the Dutch rulers of the land The area had been overrun by the Japanese in the early months of 1942 The Japanese succeeded in turning many of the natives against the Dutch The doctrine of Asia for the Asiatics seemed to them a very reasonable one They scorned the offer of the Dutch to give dominion status to the Netherlands East Indies after the war

When peace came at last a number of the natives led by Dr Achmed Soekarno announced that they intended to set up an independent government When the Dutch tried to reoccupy the islands wild rioting and general disorder broke out The British landed troops in order to help the Dutch and in some places particularly in Surabaya a big naval base there was heavy fighting The British used tanks and bombing planes and many lives were lost

The British and Dutch claimed that it was impossible in a land where there were still many armed Japanese to turn over responsibility for preserving law and order to a native group Some of the revolting natives doubtless were lawless persons who took advantage of the troubled times to steal and kill others were trouble makers who had worked with the Japanese But many of those who demanded independence considered themselves to be patriots fighting for the right to be free They said that they wanted to develop the resources of the land for the benefit of the inhabitants not for the benefit of a foreign power

There was unrest and revolt too in French Indo China The people of the Indo Chinese protectorate of Annam sought complete independence from French rule Rioting broke out and here too British troops helped to maintain order A new Annamese Nationalist Government headed by Dr Tran Phan was formed in Hanoi in October 1945 It won wide support among the natives but it could not oppose the French successfully on the field of battle Dr Phan declared bitterly that the French were using tanks and other supplies sent from America on Lend Lease

India remained a trouble center in Asia as it had been for years In 1942 at a time when Japan was extending her conquests in



Sergeant Max Gluck

Near Calcutta India where the heat is stifling for a good part of the year many of the people live in thatched huts. Very young children wear no clothing and that of the grownups is loose and light in color

the Far East Great Britain had offered India full dominion status after the war in exchange for active Indian co-operation against Japan This project was called the Cripps plan because it had been brought to India by Sir Stafford Cripps a member of the British Cabinet

India rejected the Cripps plan chiefly because the British wanted to control India's defenses In August 1942 the All India Congress authorized its leader Mohandas K Gandhi to begin a campaign of civil disobedience which was intended to put an end to British rule in India Gandhi Jawaharlal Nehru and other leaders of the Congress were imprisoned and Great Britain sternly put down the rioting which followed

In June 1945 the British released Nehru and other prominent Indian leaders from prison In that month too they began a series of conferences at Simla with these leaders and other Indian representatives in an effort to bring about a new era of peace and co-operation in India But these meetings ended in failure on July 14 and the British announced that they would continue to govern India as before

THE NEW BRITISH GOVERNMENT KEEPS THE OLD INDIAN POLICY

The situation was not changed much after a Labour government came into power in Great Britain in July It soon became clear that the new government would make no important changes in British policy in India The Indian leaders were bitter there were anti British riots in Calcutta and other cities To add to the woes of India Hindus and Moslems came to blows in a series of riots in Bombay in September 1945

Farther to the west the historic land of Iran (Persia) faced a difficult situation It had passed through trying times in World War II In the early months of 1941 a considerable number of German agents posing as tourists had flocked into the country Great Britain and Russia who became allies in the war against the Axis in June 1941 were alarmed at this development In August they demanded that Iran should make all Germans leave the country

When this demand was refused British and Russian troops invaded the land and occupied it meeting little resistance The British and Russians took over the oil fields a number of bases and other places in Iran In the course of time the country became an all important channel for the flow of war materials to Russia American troops joined the British and Russians in this area in order to help keep transportation moving The Iranians declared war on Germany in September 1943 but Iran continued to be an occupied country with little power to decide its own policies

In the famous conference held in Teheran the capital of Iran from November 26 to December 1 1943 President Roosevelt Prime Minister Churchill and Premier Joseph Stalin promised that Iran would continue to be an independent country They also promised that she would lose no territory as a result of the Allied occupation

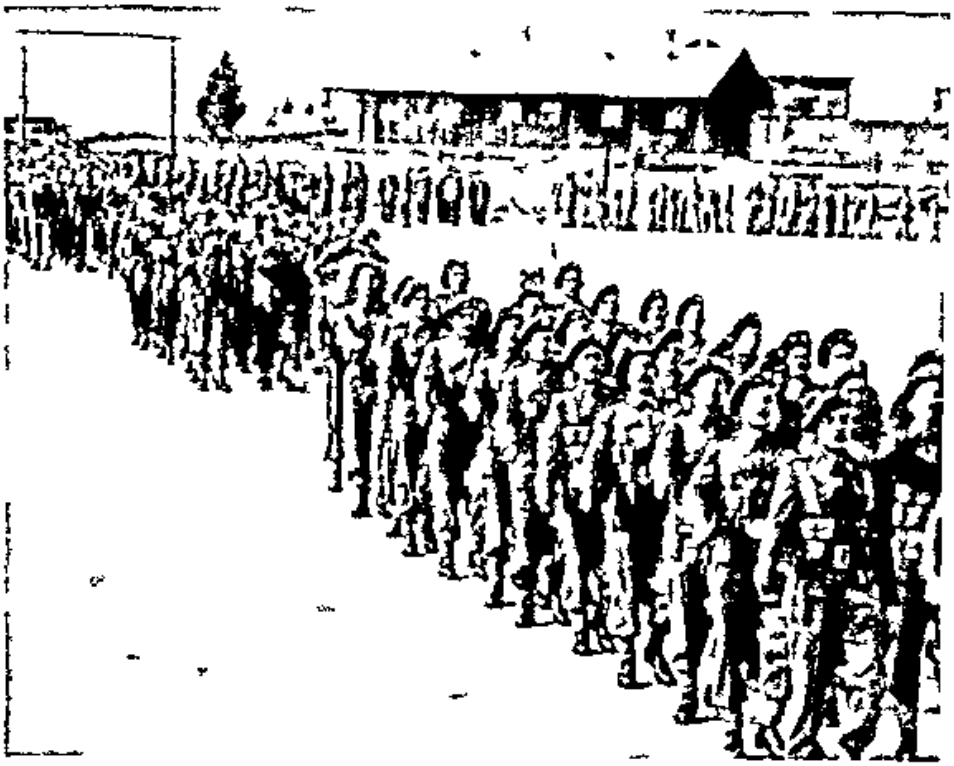
After the war came to an end at last British Russian and American troops continued to occupy key posts in Iran In October 1945 however they agreed to withdraw their troops by March 2 1946 The people of Iran waited patiently for that happy day to come

On November 16 1945 a revolution broke out in Azerbaijan Province in the northwest of Iran occupied by Russian troops. When government troops tried to enter the province in order to put down the revolt, they were turned back by the Russians The government of Iran protested claiming that Russia had no right to interfere in a matter that concerned only Iranians On November 24 President Truman proposed that all American British and Russian troops should withdraw from the country by January 1, 1946 in order to lessen the possibility of unfortunate incidents But neither Russia nor Great Britain accepted the plan In December the rebels set up an autonomous (self governing) state in Azerbaijan

TURKEY AND RUSSIA QUARREL OVER THE DARDANELLES

Turkey also had a quarrel with her big Russian neighbor in 1945 over the question of the Bosporus and the Dardanelles These two narrow straits with the Sea of Marmora which lies between them connect the Black Sea with the Mediterranean Turkey had been forced to remove all the fortifications from the straits after World War I, in which she had fought on the side of the defeated Central Powers But in 1936 following an international conference held at Montreux France the Turks received permission to fortify the straits again

Turkey remained neutral during almost all of World War II she did not go to war until February 23, 1945 when she joined the Allies only a few months before V E Day the day of final victory in Europe The



Acme

A Jewish brigade formed with the permission of the British authorities to defend the Jewish settlements in Palestine

Russians did not welcome the Turks as allies They declared that Turkey had permitted Axis ships to pass through the straits in the early days of the war

Russia now demanded the right to set up bases at the straits in order to protect her interests The Turks were naturally reluctant to have so powerful a neighbor at their back door and they refused the Russian demand In November 1945 Secretary of State Byrnes of the United States proposed a compromise He suggested that the Russians should give up their idea of establishing bases at the straits On the other hand he asked the Turks to open the Dardanelles and Bosporus to all merchant ships and to the warships of Russia Bulgaria and Rumania at all times No action had been taken on this proposal at the year s end

The Middle East also offered serious problems in 1945 There was strife in Syria and Lebanon at the eastern end of the Mediterranean Sea Before World War II these countries were under the control of France though they were called independent After the surrender of France in June 1940 Syria and Lebanon remained under the control of the Vichy Government which had taken over the rule of unoccupied France

In June 1941 an Allied expedition took over both countries in order to prevent the Axis powers from seizing them This expedition was made up of British Empire troops and pro-Ally Free French forces In September 1941 General Catroux the commander of the Free French troops in the area proclaimed the independence of Syria and Lebanon in the name of the Allies

After V E Day a crisis developed French troops continued to occupy a number of districts in Syria and Lebanon Before finally withdrawing their troops the French wanted to be guaranteed special rights in both countries The Syrians and Lebanese however wanted to cast off all ties with France When the French sent added troops into the area heavy fighting broke out In the course of this fighting the French shelled the city of Damascus Syria which is held sacred by the Syrians At last the British intervened they ordered the French troops to return to their barracks

The British restored order after several hundred persons had been killed and many others wounded On July 25 1945 an agreement was reached between the British and the French The French were to remain in the coastal areas but were to withdraw from eastern Syria though they were to retain control of certain airfields in that district In December Great Britain and France agreed to withdraw their troops from Syria and Lebanon at an early date

The Palestine problem was the thorniest of all in the Middle East Great Britain has been governing this country for years under a mandate of the old League of Nations. (A mandate was an order or commission issued

by the League it authorized a League member to set up a responsible government in a given territory) When this mandate was officially approved in 1923 it was understood that the British would help the Jews to set up a national home in Palestine Sir Arthur Balfour British Foreign Secretary had promised in 1917 that the British Government would do all in its power to bring this about

When the British took over the Palestine mandate the Arabs in that land greatly outnumbered the Jews The proportion of Jews increased considerably in the years that followed as Jews arrived in Palestine in increasing numbers The newcomers helped to build up the land and brought new prosperity to it But the Arabs became more and more hostile They claimed that they would be outnumbered by the Jews in time if unrestricted immigration continued They might then become a persecuted minority And so they wanted to check Jewish immigration to the Holy Land as Palestine is sometimes called

As time went on there was rioting and bloodshed in the Holy Land In May 1939 the British offered a plan to put an end to the strife between Arabs and Jews this plan was set forth in a document called a White Paper The British proposed to allow 75 000 Jews to enter the country over a period of five years After that time there would be no more Jewish immigration The British would then set up an independent Palestine bound by treaty to Great Britain The Jews were to have full political rights in this new state

WORLD WAR II POSTPONES THE PROBLEM OF PALESTINE

The White Paper satisfied neither the Arabs nor the Jews But in September 1939 World War II broke out and the British postponed further discussion of the Palestine question During the war the Jews of Palestine supported the Allied cause wholeheartedly They sent their young men to fight against the Axis their industries helped to supply the Allied troops in the Middle East

With the end of the war, the matter of the future of Palestine came up again An important Jewish body, the Jewish Agency laid a definite program before the British Government Among other things the agency demanded that a Jewish state should be set up in the Holy Land, and that unrestricted Jewish immigration should be permitted In August 1945 this program was approved by the delegates to the World Zionist Conference, meeting at London (Zionists are Jews who support the Jewish colonization movement in Palestine)

CONFLICT DEVELOPS OVER JEWISH IMMIGRATION INTO PALESTINE

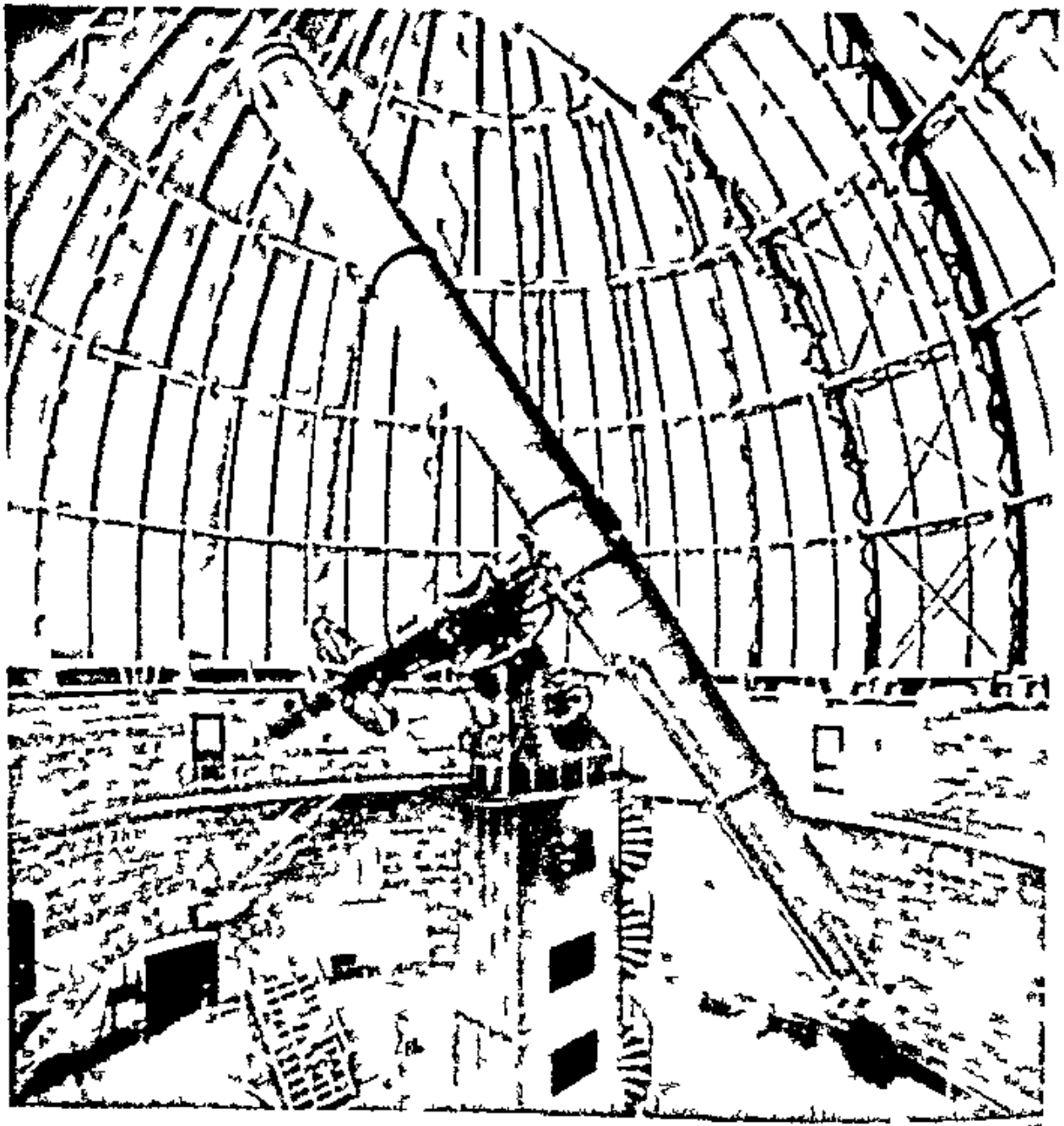
The Jewish Agency program was a long range affair In order to meet the immediate needs of Jewish refugees in the war torn areas of Europe the Zionists demanded that 100 000 Jews should be admitted at once into Palestine The British refused they announced however that 1 500 Jewish immigrants a month would be permitted to enter The Zionists declared that this offer was entirely unsatisfactory

The Arabs of Palestine were bitterly opposed to the program set forth by the Jewish Agency They received the firm support of their fellow Arabs in other lands In March, 1945 the states of Egypt Syria Lebanon Transjordania Iraq and Saudi Arabia had adopted the charter of a new Arab League The League vowed that it would not permit the setting up of a Jewish state in Palestine To show their support of the Palestinian Arabs Arab mobs in Cairo Alexandria Tripoli and other cities of North Africa looted Jewish stores, damaged synagogues and attacked Jews

On November 13 1945 President Truman and Foreign Minister Bevin of Great Britain announced a British American agreement on the subject of Palestine They proposed to set up a Joint Committee of Inquiry to examine the problem of European Jews and Palestine Bevin added that Palestine would become a trustee state of the United Nations Organization and that it would have self government in time It seems likely that there will be no further official move in the matter until the Joint Committee of Inquiry makes its report

One reason why the Palestine question is such a difficult one is that neither Great Britain nor the United States is willing to make enemies of the nations belonging to the Arab League There are vast oil deposits in Iraq and Saudi Arabia and other Arab lands in the Middle East and both the British and the United States are vitally interested in these oil deposits

And so the vast continent of Asia is in turmoil Still the situation is not hopeless. There is still hope of peace—a real peace—if the reasonable hopes of native peoples are fulfilled and if purely national interests give way to the interests of the world family of nations

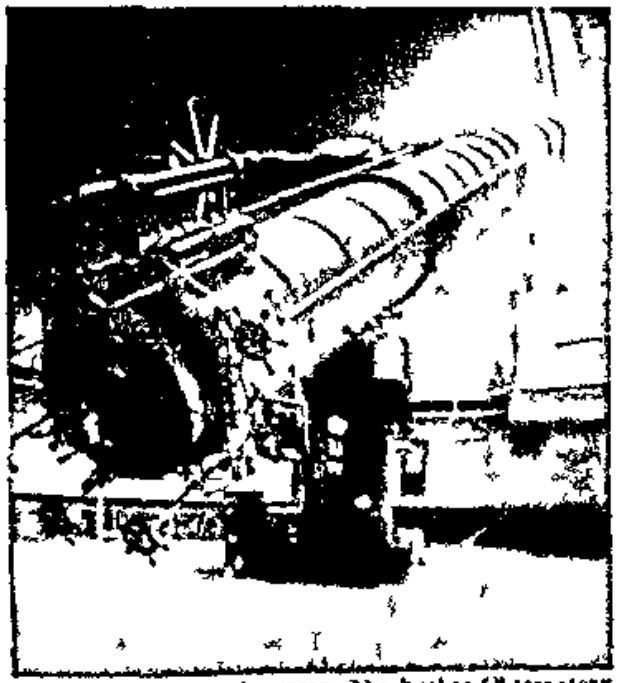


The 40-inch refracting telescope at the Yerkes Observatory. The wheels on the track at the bottom of the huge dome enable it to be turned around completely—making the telescope capable of access to any object in the sky

the light of the moon falling athwart the telescope and the floor, gives us light for our steps, although a dim, ruddy lamp on the pier serves as a guide

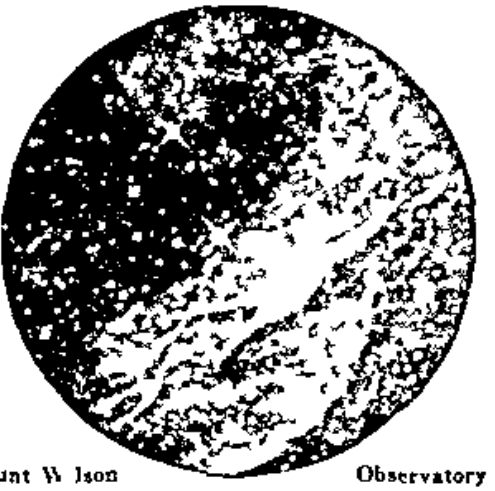
There by that lamp at last we pause Over us the monstrous shape of the giant instrument looms, it seems to be motionless yet before us, inside the pier of the telescope, behind a window of glass we see the whirling gears of a mechanism called the driving clock that is turning the telescope with infinite smoothness slowly across the sky toward the west, to follow the apparent motion of the moon or any other object to which the instrument is pointed For the earth is always rolling eastward beneath the stars, carrying us with it, as a result, the stars all appear to roll westward over us and if our telescope were not moved constantly to follow this westward motion, the object under examination would drift away from the field of view of the telescope

But now, after the astronomer has pressed a button on a small panel near the pier, we hear a rumbling sound, then feel a strange sensation of motion We are rising! The whole great floor of the room is an elevator that carries all of us, and chairs, and observing ladders, up to a convenient level so the lower end of the telescope is within easy reach! *It is the largest elevator in the world* it is circular and it has a square hole in the middle of it Through this hole the pier of the telescope protrudes, the instrument sits on a solid foundation buried in the earth while the floor does not touch it For if the floor touched the pier of the telescope every step would cause the instrument to vibrate and the vibration magnified many times by the telescope would be easily visible to the observer using the instrument No part of the telescope ever touches any part of the building



Courtesy, The Yerkes Observatory

This telescope peering through the slit in the arched dome is helping to discover the secrets of the sky



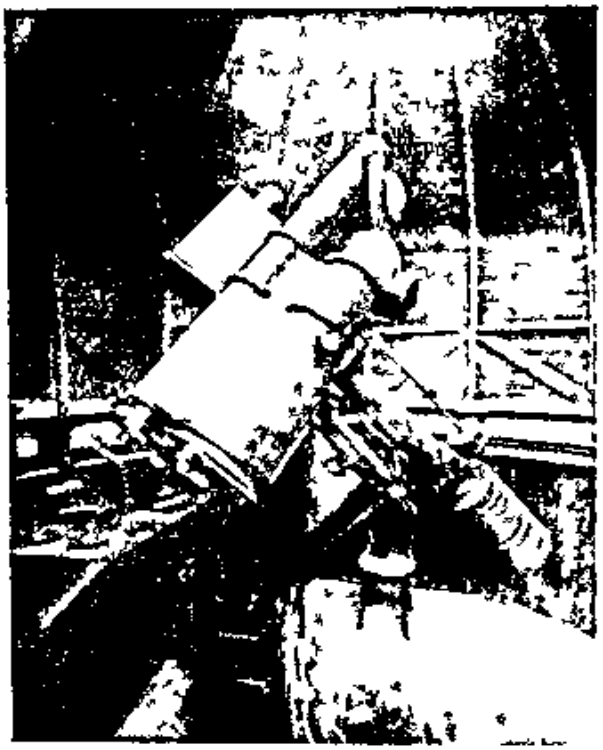
Mount Wilson Observatory

A section of the Milky Way seen through a telescope

Now we see that if we walk away from the center toward the lower end of the telescope we shall just be able to look through it without standing on any steps The rumbling sound ceases as the astronomer takes his finger from the button, and we all go out to look through the instrument But now the edge of the slit that runs from the rim to the *top of the dome is hiding some of the moon* the astronomer touches another button and a different sound is heard For a moment we feel that we are turning but then we realize that it is the dome which is turning a little so the moon's light falls full on the great lens of the telescope The astronomer steps to the lower end of the telescope, looks through the tiny lens called the eyepiece, makes a small adjustment, then invites us one by one to share the view

THE RAGGED MOUNTAINS OF THE MOON

When we first see the moon, our thoughts are strangely mixed The scene is at once beautiful and terrible There stand those ragged mountains those yawning craters and barren deserts where nothing has changed for millions of years, where nothing grows where the temperature by day is above the boiling point of water and by night is far below zero Along the line that divides the dark



Courtesy The Yerkes Observatory
This telescope is used in photographing comets

from the bright portion of the moon we see long shadows that help us discern the nature of the details The astronomer tells us that only when the moon is in some partial phase do these features show clearly He tells us there is no air and no water on the moon and that is why the scenery is so rugged and severe there has been no erosion there, no wearing down of the high places or filling in of the low places by the action of wind and water We all agree that, while the moon is a fascinating object to view through a great telescope, we are very glad we live on the earth

HOW THE TELESCOPE IS TURNED TO SCAN ANOTHER PORTION OF THE SKY

When all have seen the moon, the astronomer suggests that Saturn might be next on the program But the moon is high in the south, while Saturn is rather low in the west The astronomer goes to the center of the floor, where he presses buttons on his control panel The huge tube of the telescope changes direction, tilting so the eyepiece rises and swings to one side, as the astronomer, by reading numbers on his dials, points it exactly at the spot in the sky in which Saturn is to be found Now the dome must be turned toward the west, and once more we hear the sound as the shell of many tons rolls smoothly along railroad rails, until we see the planet Saturn through the slit But the floor is too low the proper button must be pressed, so the floor will rise and carry us once more to the eye-end of the telescope

SATURN WITH ITS BRIGHT RINGS AND ITS NINE MOONS

When all is ready, once more we take our turns The first to look exclaims, 'Why it looks just like the pictures!" and so it does Saturn is a lovely thing, poised delicately in the center of a set of rings that remind one of the brim of a hat We see no motion, yet the planet is turning much faster than the earth The millions upon millions of tiny particles which compose the rings are also revolving swiftly around their planet, ever in their proper places, so the appearance of the rings is preserved To either side, outside the rings small, starlike objects are seen they are some of the 'moons' of Saturn The planet has nine moons in all but seldom are more than five or six visible at one time Some might be hidden in the shadow of the planet and some are exceedingly faint, to be seen well only on photographs

Then we look at giant Jupiter, with its deep belted atmosphere of ammonia and marsh gas Its strong markings enable us to see its rotation the markings move across in one direction those near one edge passing out of sight around the limb or edge of the disc while new ones come into view at the other limb Four of Jupiter s eleven moons are easily visible they change their places as we watch them and one of them casts its shadow on the planet, to produce an eclipse of the sun But there is no one there to see the eclipse, for on Jupiter it is very cold and the dense atmosphere, made up of noxious gases, is not suitable for anything that lives here on earth

So the evening passes As we linger we feel that we are leaving farther and farther behind all the worries of this world we reach almost to infinity, through space and time Some of the objects we see—faint star clusters and nebulae—are so distant that their light has been thousands of years on its way to us The light we see from them tonight left there before the Pyramids were built, before man began to study science, before, even man learned to raise inquiring eyes to the everlasting stars We are a part of eternity as we stand beneath the dome and use the instrument that cunning hands devised

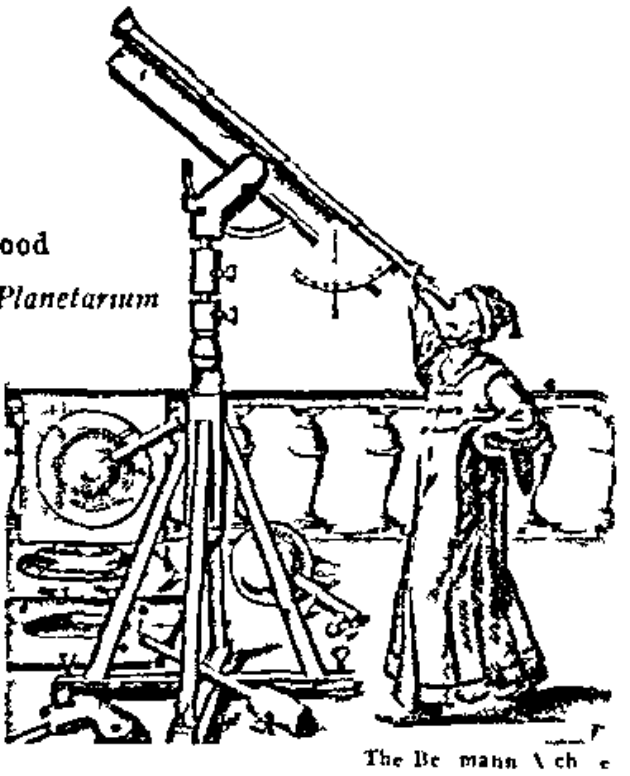
Regretfully we take our leave more silent than when we came we walk the road down the hill, our minds filled with racing thoughts of creation and of worlds without end

ASTRONOMY

THE ASTRONOMER'S WONDERFUL INSTRUMENTS

By Marian Lockwood

Associate Curator, Hayden Planetarium



The Bettmann Archive

An old time astronomer gazing through his telescope

ONE of the most interesting and inspiring of all stories is the long exciting and often beautiful tale of man's quest for knowledge. Wisdom and knowledge are of many different kinds or branches and different kinds require different methods of approach. The philosopher for instance does not use delicate and complicated instruments to help him to his conclusions. He could not even if he had the most perfectly accurate scales measure human thoughts and values by mechanical means. His material comes from his own reflections and those of others and perhaps largely from his own heart. The astronomer on the other hand starts with purely objective material with hard cold facts not with speculative data. Later after he has obtained his facts he may speculate. Theories are the result of speculation they are actually scientific guesses but they must be based *on facts known and observed*.

It would seem that the astronomer has chosen for himself a hard job. Most of the material with which he deals is so far away that he can not even see it. The explorer may travel out to visit the strange worlds he wishes to describe. The astronomer has no such chance. The nearest of the worlds he studies the moon is on an average about 240,000 miles from the earth. The nearest of *the stars beyond the sun is nearly twenty six* trillion miles away and here our imagination begins to falter for we have entered the celestial realm where distances are so vast that enormous stars much larger than our sun appear as tiny points of light even when viewed through powerful instruments.

Nevertheless the astronomer *tells* you with some confidence what the stars are like how large they are whether they are comparatively hot or cold what they are made of how fast they are traveling and in which direction. How does he know about these things? How can he possibly have learned so much and 'so far'?

The answer to these questions is simply that the story of astronomy is the story of *wonderfully accurate and delicate instruments* which astronomers have devised in the last few hundred years. The story of astronomy is also the story of light for it is only as we construct instruments to gather and analyze light the sole messenger which can come to us from outer space that we learn about the universe which stretches out in *every direction like a vast and endless sea*.

In this vast sea of space which surrounds the earth anyone with good eyesight can see at night several thousand tiny points of light which we call stars. At one time the average person can probably see about 3 500 stars. There are about 9 000 in the entire sky of which we see less than half at any one moment. But the stars which we can see with the naked eye are only a beginning. We realize *now that in our own Milky Way Galaxy* which is only one of perhaps billions of systems like it there are many billions of stars. In order to see and study the celestial universe most of which lies beyond the range of naked-eye vision the astronomer has invented ingenious and powerful instruments 'to bring the stars down to earth'. *Let us* see how he has gone about this problem.

In 1608 nearly three and a half centuries ago a Dutch maker of spectacles Jan Lippershey, constructed almost by accident a wonderful small instrument which made far objects seem closer, and dim objects clear. He made this first telescope by placing two spectacle lenses in a long hollow tube through which he looked at distant houses and people. According to the story that is told it was just by accident that Lippershey happened to put the right two lenses to-

other He never did anything of importance with his little instrument the first telescope

The word telescope is an interesting one —from the Greek word *tele* meaning far and *scopein* meaning "to watch In other words a telescope is a far watcher exactly the right name for it

THE FIRST CRUDE TELESCOPES OPENED NEW WORLDS TO THE EARLY ASTRONOMERS

In 1609 or 1610 a famous physicist in the city of Florence Galileo Galilei by name heard of Lippershey's discovery and set to work to make for himself a telescope which he could use in the study of astronomy We are told that he used a piece of organ pipe and two spectacle lenses With this crude instrument he peered at the sun and found dark spots on its brilliant surface he looked at Saturn and thought it a peculiar planet with ears or wings His telescope was not good enough to show him that these ears are really rings around the planet Galileo observed the mountains and craters on the moon and the four large moons or satellites of Jupiter which have ever since been called the Galilean satellites His telescope was not strong enough to show him the other moons of Jupiter

Galileo's telescope made a great sensation in his day People from far and near flocked to have a look through it John Milton the English poet was one of Galileo's visitors Galileo's first instrument magnified objects three diameters (A telescope's power to magnify is figured by diameters) Galileo later made a telescope with the power of eight diameters and then one that magnified thirty diameters

With Galileo's invention of the astronomical telescope began a new era in astronomy and in man's knowledge and understanding of the heavens Suddenly the universe had expanded, stretching out in all directions, and man found himself in possession of a magic arm long enough to bring down to earth sun moon and stars the very vault of heaven itself From that time on, for more than three centuries the astronomer's main concern has been to improve the instruments that help him to see, to collect the faint light of the stars in his mirrors and his lenses, and to analyze the secrets of the stars

There are two main types of telescopes the refracting telescope and the reflecting We have traveled a long distance from Galileo's tiny 'optik tube to the great forty inch the largest refractor in the world at Yerkes Observatory at Williams Bay, Wisconsin (This is the one described in A Visit to an Observatory) And it is a long jump indeed from the small reflecting telescopes of Sir Isaac Newton's day to the gigantic 200 inch at Mount Palomar, California

The refracting telescope is in its simplest form a tube with a lens called the objective at one end and an eyepiece at the other end The objective is a convex lens, that is a lens that curves outward The rays of light from a star or other body strike the lens and are carried through it and come to a point near the other end of the tube forming an image The eyepiece magnifies the image The eyepiece is mounted in a sliding tube which can be adjusted to fit the observer's eye in somewhat the same manner as in opera glasses or binoculars

The eyepieces of a telescope are changeable being of different magnifications High magnification can be used only when the *seeing* is good What do we mean by "seeing"?

THE ATMOSPHERE OFTEN DISTORTS THE IMAGE IN THE TELESCOPE

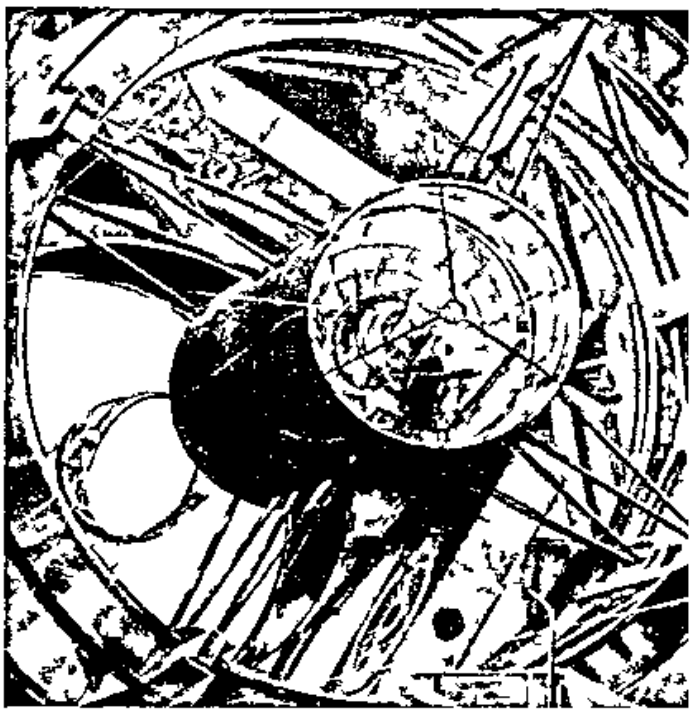
The earth is surrounded as everyone knows by an envelope of air—a mixture of gases which we call the atmosphere You have seen what happens in the atmosphere when its different layers are variously heated If you look ahead of you along a hot road in the summer you will sometimes see a shimmering and wavering of the air just above the road Or if you sit before a window under which there is a hot radiator you see the air above the radiator wavering and moving in the same way This is due to the unequal heating of different layers of air When you look out to objects beyond through these layers the objects appear to be distorted The astronomer often notices this same effect in the atmosphere through which he must look to see the stars out beyond The uneven heating of different layers of air causes a shimmering or twinkling of the stars and other heavenly bodies which makes the "seeing" poor When there is a more equal heating of the air, higher magnifications can be used, but when the seeing is poor a high magnification magnifies the distortion So the amount of magnification which can be used depends upon the stillness of the atmosphere Astronomers sometimes think with longing of the moon as the ideal place for an astronomical observatory, for there where there is no air, seeing would always be good

In the reflecting telescope the rays of light fall upon a concave mirror (one that curves inward) and are reflected from it to another

mirror and the image is reflected again this time to an eyepiece that magnifies the image Various types of reflecting telescopes are in use the most common being the Newtonian and the Cassegrainian forms In the Newtonian form the eyepiece is at the side of the tube near the top of the telescope and in the Cassegrainian type the eyepiece is at the lower end of the instrument

The largest reflecting telescope in use at the present time is the Hooker Telescope at Mount Wilson Observatory in Pasadena California This reflector has a mirror 100 inches in diameter that is eight feet and four inches across The 200-inch reflector to be installed on Mount Palomar near San Diego will be finished before long and astronomers are holding their breath to see what it will reveal beyond the present known limits of the universe

The telescope is the basic instrument of the astronomer It is used not only in actual observing but in combination with other instruments The main purpose of the telescope is not as so many people erroneously believe to magnify though it does make things appear larger The primary importance of this instrument is in collecting the light coming from distant objects objects which would be too faint for the astronomer to study without optical aid The telescope gathers and intensifies light so that the astronomer may study it by means of other instruments attached to the telescope The resolving power of the telescope is extremely important also That is objects which are so close that they appear to the eye as one are seen through the telescope to be separate The telescope is furthermore a good pointer to indicate positions in the sky



The great 200-inch reflecting telescope at Mt. Palomar

THE CAMERA "SEES" MUCH THAT IS INVISIBLE TO THE HUMAN EYE

The telescope in team work with the photographic camera forms one of the astronomer's most important tools The large telescopes are today used almost entirely in this way The camera is attached to the seeing end of the telescope or where the eyepiece would be With the camera we can photograph objects that could not possibly be observed through the telescope by the eye

A very faint star for instance does not give sufficient light for the human eye to see And the longer the observer looks the less well he sees for the eye tends to tire Put a camera in place of the eye however at the seeing end of the telescope and what do we have? In the camera is a photographic plate covered with a sensitive emulsion which registers the presence of light however faint During a long time-exposure the camera's eye does not become tired as a human eye would The little point of light which represents the distant star continues to shine upon the emulsion finally making an impression and recording its presence there This point of light can then be studied by the astronomer at leisure when the plate is developed

Telescopes are fitted with driving clocks which keep them turning at such speed that the same stars are always centered in the field of view If the telescope did not turn to compensate for the rotation of the earth and the apparent westward motion of the stars the images of the stars would appear as streaks of light instead of points

Yes the telescope and the camera together form a wonderful team for recording the presence and movement of the heavenly bodies So much for collecting light There are other extremely complicated instruments which are often used with the telescope and camera and by means of them we are able to break up and analyze the light which comes from the stars But first we must understand the principle on which these instruments work.

In 1666 nearly three hundred years ago Sir Isaac Newton one of the greatest physicists of all time discovered a basic fact on which most of modern astronomy and astrophysics is founded By passing a ray of sun

l ght through a prism Sir Isaac found out that sunlight or white l ght is composed of all the colors of the rainbow In other words white light is not *plain* white light but a mixture of light of different colors or differ ent wave-lengths

THE WONDERFUL SECRET OF THE SPECTRUM WHICH NEWTON FOUND BUT COULD NOT USE

The band of colors which we observe when we break up wh te l ght is known as the spec trum Red light which has the longest wave length of any l ght vis ble to the human eye is at one end of the spectrum and violet light wh ch has a wave length about half as long as red is at the other end Sir Isaac Newton had discovered the key to one of the great secrets of the universe but he did not learn how to use the key An instrument that breaks light up into the spectrum, is now used It is called a spectroscope

There are many adaptations of the spec troscope but if we understand the basic principle upon which it works we shall see eas ly how it fits into the astronomer s work The modern spectroscope is an instrument into which l ght enters through a very nar row slit perhaps only a few thousandths of an inch in width The light then passes through a lens known as a collimating lens wh ch straightens out the diverging rays of light and makes them parallel These parallel rays of light from the sun or from any oth er heavenly body then pass through a prism wh ch breaks up the light into the colors of which it is composed This band of colors the spectrum is focused by an objective and then studied through a small telescope at tached to the other end of the spectroscope

The spectrograph is this same type of in strument but adapted for photographic work Other adaptations known as the spec trohelioscope and the spectroheliograph are used in observing the sun under special con d tions Whenever you see *helio* in a word you can be pretty sure that the word has something to do with the sun

But now that we have the band of colors spread out before us how do we use the key that Newton discovered? We use it to learn what the universe is made of

Each chemical element in the universe possesses a distinct fingerprint just as each individual person has a fingerprint different from those of every other person in the world By its distinct fingerprint an element can be recogn zed whether it happens to exist in a laboratory on the earth or in the most remote star Each chemical element is recognized by its own distinct pattern of lines and colors in very definite places al ways the same in the spectrum When we observe certain yellow lines in the spectrum always in the same position in relation to the other lines we recognize the fingerprint of the element sodium When those lines oc cur either in the spectrum of sunlight or in the spectrum of a distant star, we know that sod um is present in the body in incandes- cent (glowing) gaseous form And so with all the other elements

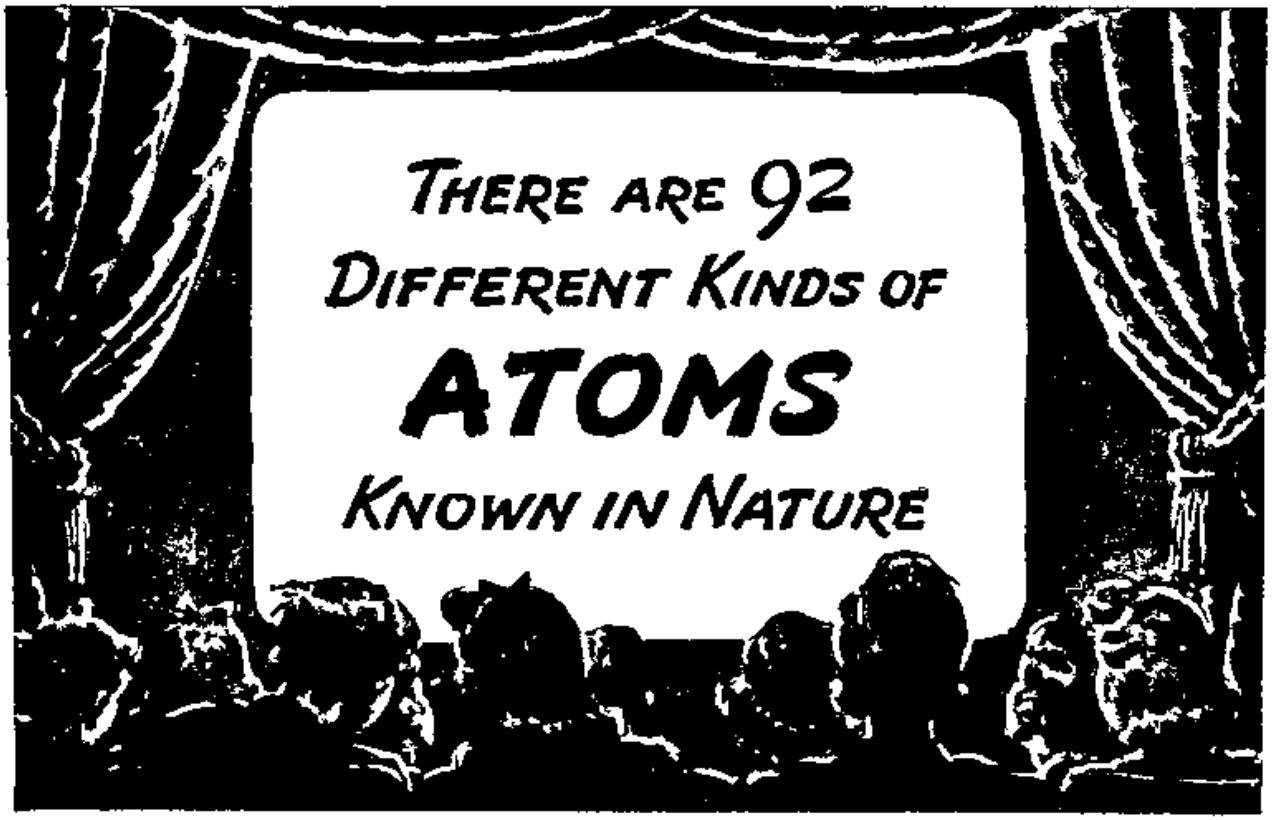
In this way by recognizing the spectral lines of any element we are able to identify the materials of which the stars are com posed or those which are present in the at mospheres of the planets We have identified in the sun more than sixty of the ninety two elements known The gas helium was discov ered on the sun twenty seven years before it was found on the earth—discovered of course through a peculiar pattern of l nes which indicated in the solar spectrum the presence of an element not as yet known to man Later that same pattern of lines showed up when helium was discovered here The name helium comes from Helios the Greek name for the sun god

If the star or other heavenly body which is the source of the light being analyzed is moving away from the earth there is noticed in the spectrum a definite shift of the lines toward the red end If the body is approach ing the l nes shift toward the violet end The astronomer can tell by examining the spectrum how fast the star is moving

HOW WE MEASURE THE STARS AND TAKE THEIR TEMPERATURE

By other instruments the interferometer and the bolometer the astronomer can esti mate the size and the temperature of stars But in each case the all important thing is l ght the messenger of the universe With out light the instruments are useless We have since about 1860 learned to interpret more correctly the messages which l ght is constantly sending to us from all parts of the universe We have learned more also of the structure of the universe and of our own comparative loneliness in space We have learned too how small and unimportant our earthly home is

One thing not even our most del cate in struments can tell us as yet Are there other planets other solar systems perhaps with living be ngs? Possibly some day we shall have instruments that will tell us definitely yes or no



ATOMS AND ATOMIC ENERGY

By **Thomas H Osgood**

WHEN the first warm days of summer come, we all enjoy seeing flowers and vegetables growing in our gardens and fields They grow so fast that the difference in size can be noticed almost from day to day They all started from tiny seeds so we naturally believe that most of the stuff in the fruits and leaves must have come out of the ground, or out of the air, or out of the rain, or out of the fertilizer which was used Later on we eat the vegetables—the tomatoes, the carrots, the corn and the beans By eating these and other things children grow heavier and taller, their bones grow stronger their hair grows longer So we must also believe that most of the stuff of which children and adults, are made must have been contained in the food they ate, or in the air they breathed, or in the water they drank If you think about this a little you will want to ask

Are there the same ingredients in the soil, in the vegetables and in ourselves?'

Men have sought the answer to this question for centuries They have learned how to take the carrot to pieces, and the soil also and wood and coal and sugar and salt and all other kinds of matter that we see around us They have found out what *we* are made of, also

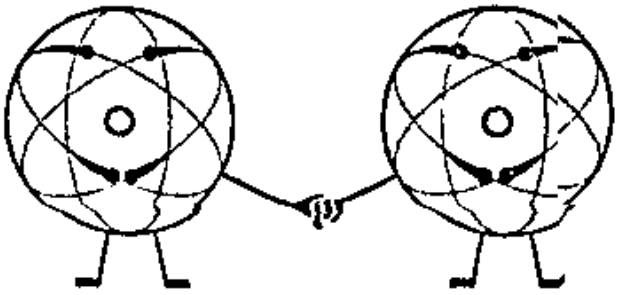
Yes, it is true that you will find some of the same ingredients in the soil the air, the rain, the carrots and other vegetables and ourselves Now here is a very wonderful thing Cut a carrot up, and keep cutting until you have the smallest possible piece of carrot, and you have a tiny, tiny piece of matter You have such a tiny piece of matter that you can not see it—you can not see it with any microscope, though you might see an enlarged image of it by the wonderful electron microscope

*We call this tiny piece of anything a mole*cule, which means 'small piece' Now a molecule itself, though it is so tiny, is made up of even tinier parts In most cases, however, the parts are not the same as the matter we started with The parts of a carrot molecule are not carrot, for instance

These parts that combine to form molecules are called atoms The molecules of

Announcement has lately been made of the finding of additional atoms These pages tell of man made atoms 93 and 94

some things (water, for instance) have just two kinds of atoms locked together Other materials have many different kinds of atoms Some molecules are rather simple, others are complex, with hundreds of atoms of various kinds, combined according to rules of nature We have not yet discovered all



How some atoms join together to form a molecule Each individual of this tribe possesses only one arm

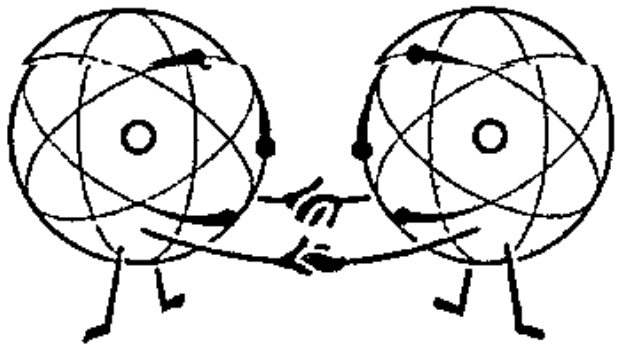
these rules, but we know some of them

New molecules are continually being discovered by chemists to add to the thousands we already know But in all the world—and in the sun the moon and the stars—there are only ninety two different kinds of atoms As you know man has lately learned how to *do very wonderful things with the atoms*, changing some of them at will But it is still true that in nature there are just ninety two different kinds of atoms It is the way in which these atoms form into groups that make the great wide, varied world we see, and everything in it

You can understand this if you think of a piano There are only eighty eight keys, yet their sounds can be combined in countless tunes

Now let us consider the ninety two different kinds of atoms Some are very familiar to us Every day we see materials made of only one kind of atom Iron, for example, contains atoms of only one kind, and therefore one of them is called an iron atom The atoms of mercury in your mother s fever thermometer are all of one kind, they are mercury atoms Silver, gold and lead are each made of only one kind of atom, though we often mix them with other materials to make them stronger metals, called alloys, for daily use

When a substance is made up of atoms of one kind only it is called a chemical element Familiar chemical elements are iron, copper



Other atoms combine to form molecules by "double bond" as this union is called Each individual of this tribe possesses two arms

and aluminum which are metals oxygen, hydrogen and helium, which are gases carbon, sulphur and phosphorus which are solids but not metals, mercury is a liquid Some chemical elements can be told by their appearance, although appearance alone is not reliable as a final test Copper is reddish aluminum is greyish, sulphur is yellow, carbon is sometimes black sometimes colorless These special colors of some of the chemical elements must not however be thought of as the colors of the individual atoms of which they are composed The particular reddish color of a chunk of copper is not due to any color of the individual copper atoms, but is



If you were making a cardboard village you could arrange the buildings as you liked in order of value perhaps. Column 3, on the next page, arranges the atoms according to weight, putting hydrogen, the lightest, in first place.

caused by the special way in which the atoms are put together to make the solid piece

As we have said *there are only ninety two known different kinds of atoms, or chemical elements* Every bit of matter in the world is made up of some combination of these ninety two Although we say that they are all different, nevertheless some show a sort of family relationship To understand this think first of the buildings in a village They could be listed in order of size starting at the smallest and ending with the largest A number could be assigned to each starting with 1 for the smallest and going on until all the buildings were numbered

Another number could also be put opposite each building on the list representing let us say the value of the building Usually but not always the value would be greater the larger the building And finally some descriptive term could be added to each entry on the list such as garage shop or dwelling

TABLE I THE ELEMENTS

Column 1 Name of element
Column 2 Chemical symbol or abbreviation
Column 3 Atomic number
Column 4 Approximate atomic weight
Column 5 Form when pure
G gas M metal L liquid
N non metal V variable

Hydrogen	H	1	1	G	Silver	Ag	47	108	M
Helium	He	2	4	G	Cadmium	Cd	48	112	M
Lithium	Li	3	7	M	Indium	In	49	115	M
Beryllium	Be	4	9	M	Tin	Sn	50	119	M
Boron	B	5	11	N	Antimony	Sb	51	122	V
Carbon	C	6	12	V	Tellurium	Te	52	128	V
Nitrogen	N	7	14	G	Iodine	I	53	127	N
Oxygen	O	8	16	G	Xenon	Xe	54	131	G
Fluorine	F	9	19	G	Cesium	Cs	55	133	M
Neon	Ne	10	20	G	Barium	Ba	56	137	M
Sodium	Na	11	23	M	Lanthanum	La	57	139	M
Magnesium	Mg	12	24	M	Cerium	Ce	58	140	M
Aluminum	Al	13	27	M	Praseodymium	Pr	59	141	M
Silicon	Si	14	28	V	Neodymium	Nd	60	144	M
Phosphorus	P	15	31	N	Illinium	Il	61	?	M
Sulphur	S	16	32	N	Samarium	Sm	62	150	M
Chlorine	Cl	17	35	G	Europium	Eu	63	152	M
Argon	A	18	40	G	Gadolinium	Gd	64	157	M
Potassium	K	19	39	M	Terbium	Tb	65	159	M
Calcium	Ca	20	40	M	Dysprosium	Dy	66	162	M
Scandium	Sc	21	45	M	Holmium	Ho	67	164	M
Titanium	Ti	22	48	M	Erbium	Er	68	168	M
Vanadium	V	23	51	M	Thulium	Tm	69	169	M
Chromium	Cr	24	52	M	Ytterbium	Yb	70	173	M
Manganese	Mn	25	55	M	Lutecium	Lu	71	175	M
Iron	Fe	26	56	M	Hafnium	Hf	72	179	M
Cobalt	Co	27	59	M	Tantalum	Ta	73	181	M
Nickel	Ni	28	59	M	Tungsten	W	74	184	M
Copper	Cu	29	64	M	Rhenium	Re	75	186	M
Zinc	Zn	30	65	M	Osmium	Os	76	192	M
Gallium	Ga	31	70	M	Iridium	Ir	77	193	M
Germanium	Ge	32	73	M	Platinum	Pt	78	195	M
Arsenic	As	33	75	V	Gold	Au	79	197	M
Selenium	Se	34	79	V	Mercury	Hg	80	201	MI
Bromine	Br	35	80	NL	Thallium	Tl	81	204	M
Krypton	Kr	36	84	G	Lead	Pb	82	207	M
Rubidium	Rb	37	85	M	Bismuth	Bi	83	209	M
Strontium	Sr	38	88	M	Polonium	Po	84	210	M
Yttrium	Y	39	89	M			85		
Zirconium	Zr	40	91	M	Radon	Rn	86	222	G
Columbium	Cb	41	93	M			87		
Molybdenum	Mo	42	96	M	Radium	Ra	88	226	M
Masurium	Ma	43	?	M	Actinium	Ac	89	227	M
Ruthenium	Ru	44	101	M	Thorium	Th	90	232	M
Rhodium	Rh	45	103	M	Proto-actinium	Pa	91	231	M
Palladium	Pd	46	106	M	Uranium	U	92	238	M



It would be a strange village if every eighth building were a garage with a church next, then

When atoms are listed in this way Table I is obtained The first column of Table I tells the name of the atom hydrogen, or nitrogen, or another The next column gives the usual abbreviation of the name, or its chemical symbol often the first two letters of its name in Latin Then follows a number, called the atomic number which ranks the atom in order of size, or weight Next the atomic weight of the atom is given, counting hydrogen as having weight 1 And finally a letter is given to tell whether the atom ordinarily joins with other identical atoms to form a metal, a non metal, a gas, or a liquid Thus we read Copper, Cu 29, 64, M—which tells that the chemical symbol for copper is Cu that it is 29th from being the lightest atom that a copper atom is 64 times as heavy as a hydrogen atom and that the material copper is a metal under ordinary conditions So we see that the table gives a good picture of each element

We would think it a very strange village if every eighth building in the list starting with No 2 was a garage and every eighth building starting with No 3 was a drugstore, and every eighth building starting with No 4 was a residence, and every eighth building starting with No 5 was a bakery Yet this is just the kind of thing we find in the table of the various elements

When applied to atoms and chemical elements, this strange regularity is known as the periodic law To make the meaning clearer, some of the atoms from Table I have been set down in crossed columns in Table II, which is part of the Periodic Table used by chemists

Reading the atomic numbers across, you have 2, 3, 4, 5 6, 7, 8, 9, 10, 11, 12, 13, 14 15, 16 17, 18, 19, 20, 21, 22, then some jumps then 33 to 40, then more jumps, then 51 to 56

The atomic numbers remember, tell the way the elements rank in weight, beginning with the lightest, hydrogen

Now read down, beginning with 2, Helium 2 10-18, 3 11 19 4 12 20, 5 13 21, 6 14 22 7 15 8 16 9 17

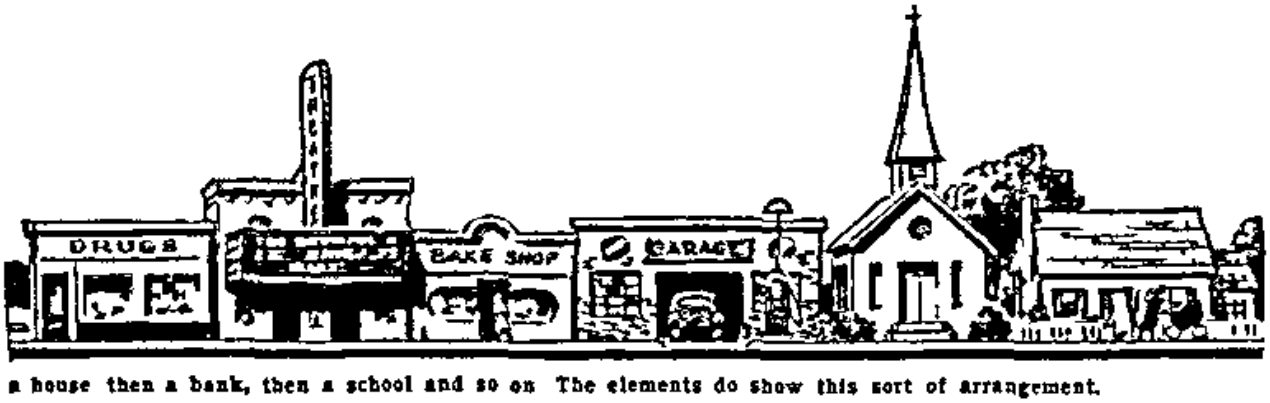
The pattern is not perfect, but again and again you see the atomic groupings themselves, eight atomic numbers apart

Is this just a matter of chance? No The atoms in the columns really are related Numbers 4, 12, 20, 38 and 56 (beryllium, magnesium, calcium, strontium and barium) which fall into the same column have very similar properties They are all metals, they look somewhat alike and they behave very much alike, so much so that chemists often have difficulty in telling from their behavior which is which

Again as a result of this grouping by eights, five elements, helium, neon, argon, krypton and xenon find themselves in one column These elements are all gases their chemical behavior is identical, in that they will not

TABLE II PERIODIC TABLE

O	I	II	III	IV	V	VI	VII
2He Helium	3Li	4Be	5B	6C	7N	8O	9F
10Ne Neon	11Na	12Mg	13Al	14Si	15P	16S	17Cl
18A Argon	19K	20Ca	21Sc	22Ti			
					33As	34Se	35Br
36Kr Krypton	37Rb	38Sr	39Y	40Zr			
					51Sb	52Te	53I
54Xe Xenon	55Cs	56Ba					



a house then a bank, then a school and so on The elements do show this sort of arrangement.

enter into chemical combination with any other elements Thus they are called inert, or *noble, gases, because they stand aloof It is* this nobility which makes helium so valuable for airships and blimps It can not combine with oxygen or with any other element to make an explosion

A story of relationship can be told about the elements in any other column of this Periodic Table Similar elements fall into the *same column, but elements in one column* say IV, are quite different from those in, say VII

Let us go back for a moment to Table I You will notice that spaces 85 and 87 are empty These must be left unfilled for elements which have not yet been discovered like seats in a theater for which tickets have been sold, but which are not yet occupied No other element has any right to be put there

The whole study of chemistry, part of the study of physics and some of astronomy are based on what you have just learned about these ninety two elements The next step is to see how they combine to form molecules, and so build up the other materials in our world

Atoms do not combine helter-skelter, but according to strict rules, beautiful rules of harmony We spoke earlier of the eighty-eight piano keys You can not make chords just by striking any notes together You must learn the rules You must learn what notes can be sounded together to make beautiful new sound patterns

It is the same with combinations of atoms Some, as we have said, will not combine at *all Those we call the noble, or inert gases* Different atoms do not always combine one and one, but sometimes one and two or one and three, or two and three This orderly and regular behavior is governed by a number called valence Different atoms have valence 0, 1, 2, 3 or 4 You would not be far wrong in thinking of an atom as having hooks by *which it could attach itself to other atoms* There is one strict rule, however Every hook must be used The number of hooks is the valence of the atom The noble gases have valence 0 They do not combine with other atoms Magnesium has valence 2, chlorine 1 Therefore one atom of magnesium hooks on to 2 atoms of chlorine, leaving no hooks unused The compound is magnesium chloride, written $MgCl_2$

Oxygen, however, also has valence 2, so one atom of magnesium can combine with one of oxygen, each atom using its two hooks like two children each holding both the other's hands The compound is magnesium oxide, written MgO

Turning once more to the Periodic Table we see that the atoms are classified also according to valence In column I all the elements have valence 1 In column II, the valence is 2 Other valence numbers are column III, 3, column IV, 4, column V, 3 column VI, 2, column VII, 1, and of course column O, 0 Thus by looking at the Periodic Table carefully, one can predict how



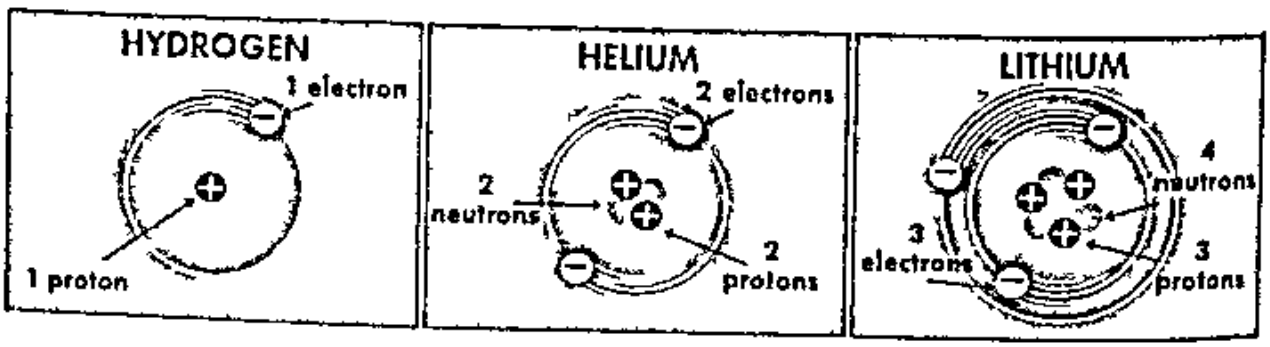
The noble gases as they are called, will not combine with other elements, but stay aloof Helium neon, argon, krypton and xenon are noble gases. Helium, the lightest of them, is the best gas to use in balloons.

different atoms will combine if they combine at all For example Ca(2) and F(1) make calcium fluoride CaF_2 Na(1) and Cl(1) make sodium chloride NaCl which is the chemical name for common salt

A brick wall is made of bricks so is a pile of bricks dumped from a truck The one is much neater and better looking than the other This difference in appearance depends on how the bricks are put together to make the wall or to make the rough pile There are several kinds of atoms which can be put together in different ways for example carbon and selenium to take only two which are marked with V (for various) in Table I Carbon atoms joined in one way make diamonds in another way, they make graphite Both these substances are pure carbon but the atoms are put together in different ways Diamond is very hard, graphite is very soft

Selenium can be made when pure, in three forms (a) red crystals, (b) red but not crystalline and (c) gray metallic crystals Only the third variety conducts electricity at all well Different forms of pure chemical elements such as these are called allotropic modifications, or allotropes Not all elements which occur in different allotropic forms are so indicated in Table I Many elements are so rare that they can not be obtained pure enough or in sufficient quantity to provide material for experiments

LOOKING INSIDE THE ATOM



We have seen that the smallest possible piece of table salt a molecule of salt is made up of two even smaller bits of matter an atom of sodium (Na) and an atom of chlorine (Cl) We write the combination

NaCl

Sodium is a metal Chlorine is a gas Their atoms combine to form the gritty salt we use every day

How do they do it? Before we try to learn the answer to that question let us find out what an atom is

The word atom means uncuttable Some scientists of olden days thought an atom could not be cut They thought it was a tiny tiny tiny bit of matter the smallest possible bit and that the bits were all alike in any one substance

But we know now that an atom small as it is really is made up of still smaller particles of matter and there are several different kinds of particles They are not thrown together helter skelter but arranged in a beautiful pattern Inside the atom there is constant change and motion

So now let us look into an atom of hydrogen It is the lightest element and a single hydrogen atom is the simplest kind of atom In the center is a mass of substance called a nucleus Near it but not always in the same position is a much smaller bit of matter called an electron The mass that makes the hydrogen atom's nucleus is called a proton

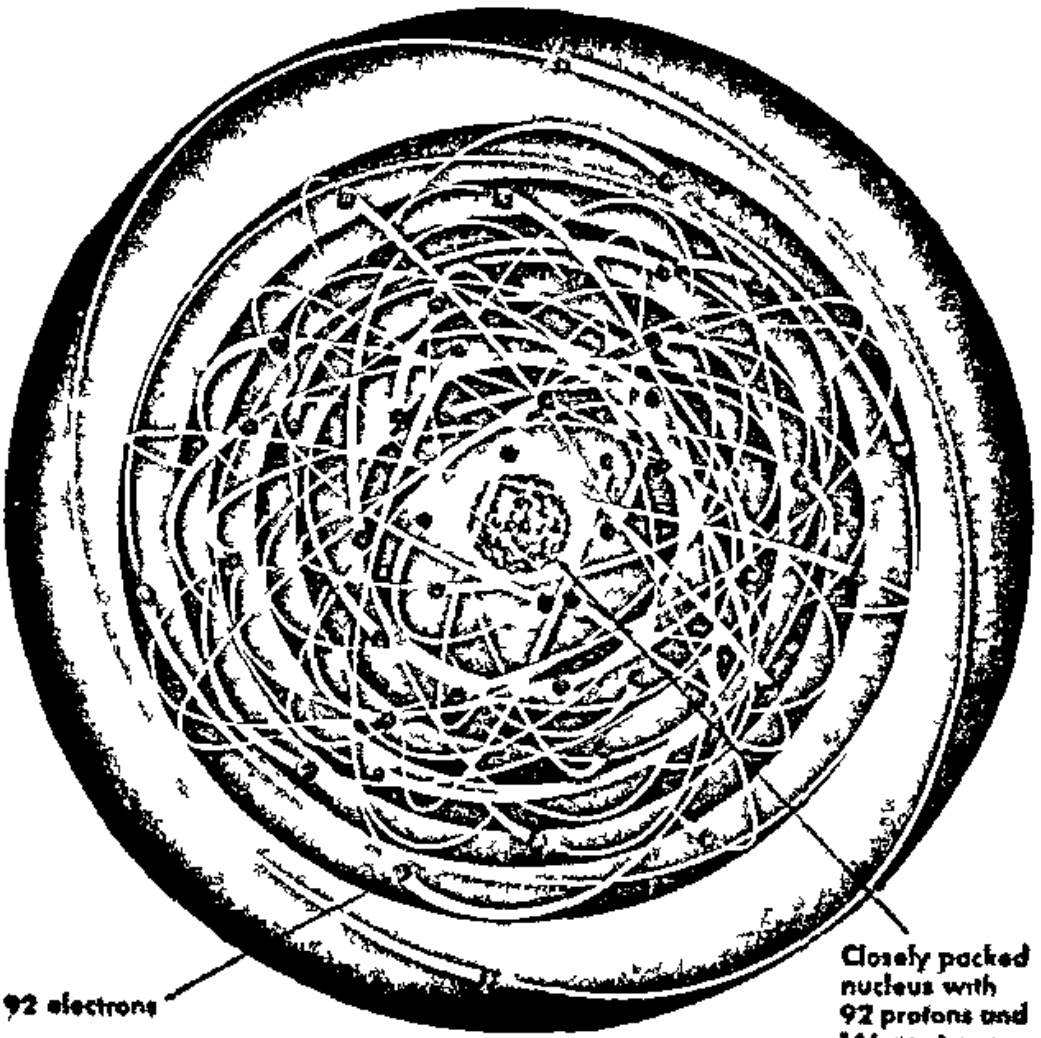
You know that there are two kinds of electricity which have the names positive and negative Now the proton of the hydrogen atom carries (or is charged with) positive electricity The electron carries negative electricity The proton is about 1 850 times as heavy as the electron but their electric charges are equal and opposite

Since the electric charges are equal and opposite, the atom as a whole has no electric charge $-1 + 1 = 0$ This is true of every atom—its electrons are balanced in positive and negative electric charge

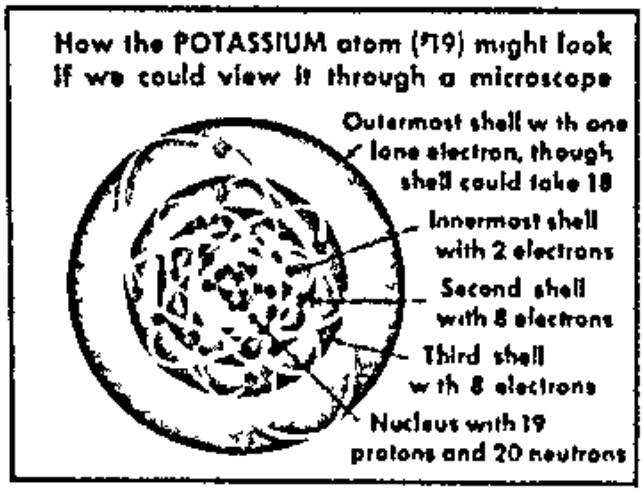
Now let us look into an atom of the next element helium with atomic number 2 We see a nucleus and 2 electrons In the nucleus are 2 protons, which balance the electrons and the nucleus also has 2 other particles of about the mass of protons yet without any electric charge They are neutrons The mass of the electrons is so small as to be insignificant It is the nucleus by which we tell an

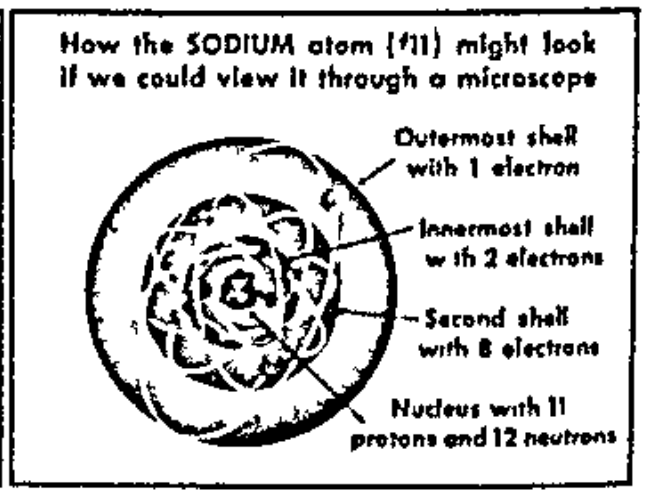
URANIUM (92)

the heaviest atom known in nature



No one ever saw an atom. Not even the most powerful microscope ever made could bring within our sight the biggest and heaviest atom known in nature: that of uranium. However, scientists are fairly sure of some things about atoms, and here our artist gives an imaginary picture of a single uranium atom, based on what the scientists believe. In the center is the nucleus, a hard core of tightly packed particles—92 protons, shown in black, and 146 neutrons, shown in gray. Around the nucleus move 92 electrons, shown in blue. Every proton is positively charged; every electron has a negative charge equal (but opposite) to the charge of a proton; and every neutron is thought to consist of an electron and a proton tightly locked together. So the atom as a whole has no charge. A neutron weighs just a little more than a proton. The electrons move in pairs around the nucleus; some near the nucleus, some far out, some in between. The artist has shown them as if they moved in shells; but of course the shells are not real; they are as imaginary as the earth's Equator or the North Pole. They help us to get a fairly clear idea of what the atom may be like.





atom s weight We see by the table on page 45 that helium weighs four times as much as hydrogen—now we know why Hydrogen has 1 proton, helium has 2 protons and 2 neutrons

How about lithium the third element? A lithium atom has 3 electrons round about the nucleus In the nucleus are 3 protons to bal ance the 3 electrons in electric charge and 4 neutrons The lithium atom must be there fore seven times as heavy as the hydrogen atom and when we look at our table page 45, we see this is correct The atomic weight is 7 Look at the table once more Column 3 gives the "atomic number" The atomic number is really the number of electrons (or the number of protons) the atom has Neon has 10 electrons and therefore 10 protons Its atomic weight is 20 so it must have 10 neutrons and that is correct

Down at the bottom of the list uranium the heaviest atom, has atomic number 92 Its weight is 238, therefore you can figure for yourself the number of neutrons—146

The heavy atoms each have a swarm of electrons near the nucleus Lead for exam ple has 82 As a result, the nucleus is very well protected from outside interference If you lived in a house surrounded with 82 traffic lanes, and your friends had to dodge cars on all those lanes every time they came to see you, you would probably not have many visitors Fortunately, the situation is not really so complicated, because the elec trons near a nucleus obey very rigid traffic rules They stay in shells, we say, when we use the proper technical term But you can think of them as circling in traffic lanes

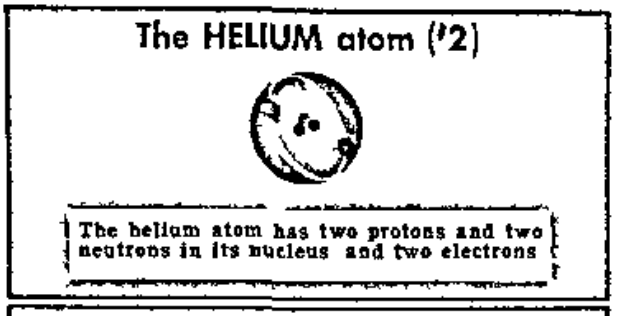
In an atom the first lane nearest the nu cleus, has room for only 2 electrons at any time The lane outside the first has room for 8, the one after that, 8 the next one 18, and so on until all the electrons are accounted for For example potassium, with 19 elec trons has them circling 2 in the first lane 8 in the second 8 in the third, and only 1 in the fourth although there is room in the fourth lane for 17 more

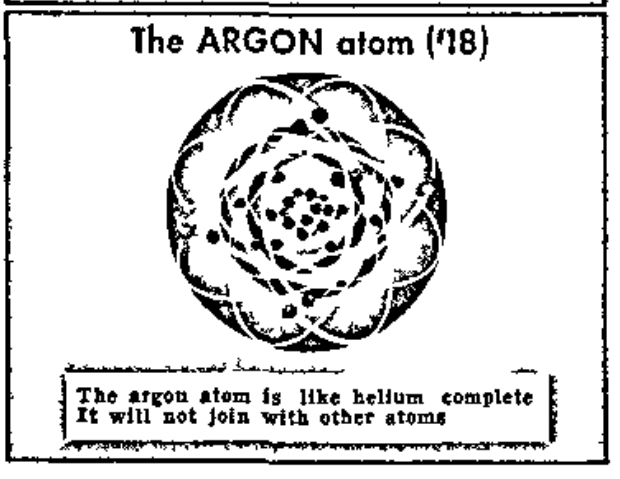
These traffic lanes or electron shells are not all equally spaced around the nucleus in the way that rings on a shooting target often are The actual distances do not mat ter very much to us, but it is important to know that the shell nearest to the nucleus is very close to it, and that the outermost shell which has only one electron in the case of potassium is very much farther out than any of the other shells Yet in spite of all this complex structure, the diameter of the potassium atom, which means the diameter of the outermost electron shell, is only about one hundred millionth of an inch If now we imagine that we have special microscopes and take a quick look at a potassium atom we would naturally see the most prominent part of it first, which would be the compara tively large shell in which the lone outermost electron was revolving We would notice some sort of tiny structures at the center of this shell but would probably not pay much attention to the details Actually it would contain the nucleus and the inner shells of electrons

If we took a quick glance at a sodium atom, we would notice one electron moving in the outermost shell, and, far inside the nucleus and two other tiny shells. The potas sium and sodium atoms both have one very large shell for the single outermost electron, and a central nucleus with other small shells of electrons round it *The chemical nature of an atom is entirely governed by the outer most shell of electrons* For sodium and po tassium these shells are identical It is small wonder, then, that sodium and potassium are similar chemical elements and are therefore

put along with hydrogen in the first column of the Periodic Table where the valence is 1 (page 46)

The same sort of explanation can be given for atoms in other columns of the Periodic Table The noble gases in column O are a rather special case In all these atoms—helium neon argon etc—the outermost traffic lane or electron shell is full There is no room for any more electrons And when the shell is full it is just as though the atom

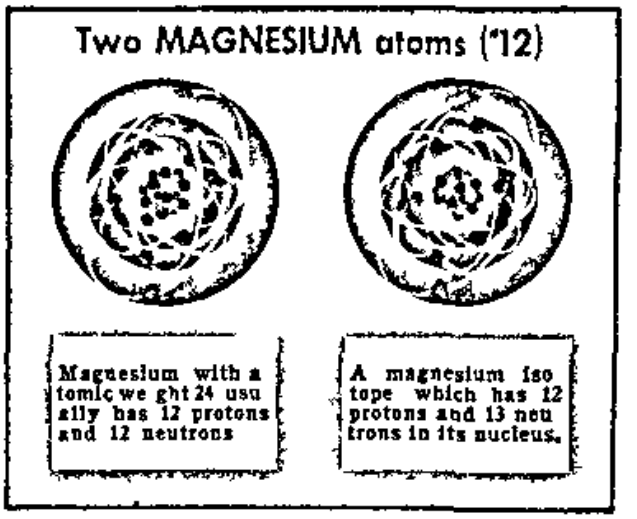




built up a wall round itself and would have nothing to do with its neighbors That is why the noble gases stand aloof and do not combine chemically with any other atoms

Let us take a look at magnesium The table of atoms tells that it is the twelfth lightest atom, and therefore has 12 electrons circling round its nucleus These are arranged in two full shells containing 2 and 8 electrons respectively with the remaining 2 electrons in a very wide shell The nucleus must have a positive charge of 12 and therefore contains 12 protons The atomic weight is 24 so there should also be 12 neutrons in the nucleus

It has been found however that the mass of the nucleus is not nearly so important as its charge The nucleus of magnesium *must* have a charge of 12 but it need not have a mass of 24 Suppose another neutron or even 2 were added to the nucleus The charge of the nucleus would still be right for



magnesium and the outside electrons could be arranged just as before Actually some magnesium atoms have nuclei constructed in this way giving them masses of 25 and 26 but keeping the positive charge at 12 Such alternative atoms are called isotopes

A piece of ordinary magnesium metal always has about 78 per cent of atoms with mass 24 11 per cent with mass 25 and the other 11 per cent with mass 26 We do not know exactly what determines these percentages These isotopes are perfectly good magnesium atoms Chemical tests can not tell them apart an instrument called a mass spectrograph is needed

You might think that a great number of other isotopes of magnesium might exist But they do not There is actually one other of mass 27 (12 protons 15 neutrons) but no sooner do physicists put it together than it falls apart again It is unstable or radioactive Why so few stable isotopes exist we really do not know When we have found out more about protons and neutrons we may be able to answer the question

Most elements consist of several isotopes There is even a kind of hydrogen atom with mass 2 called heavy hydrogen but it is very rare Tin has as many isotopes as any element It has 10 all of course of atomic number 50 and ranging in atomic weight from 112 to 124

Uranium has several isotopes The most famous is uranium 235 Men have found how to split uranium 235 in two and through this operation they learned to make the fearful atomic bomb We tell you more about this on page 53 under Atomic Energy

We now have a picture of a typical atom—a nucleus surrounded by shells of electrons with the electrons circling continuously All but the outermost shell have their

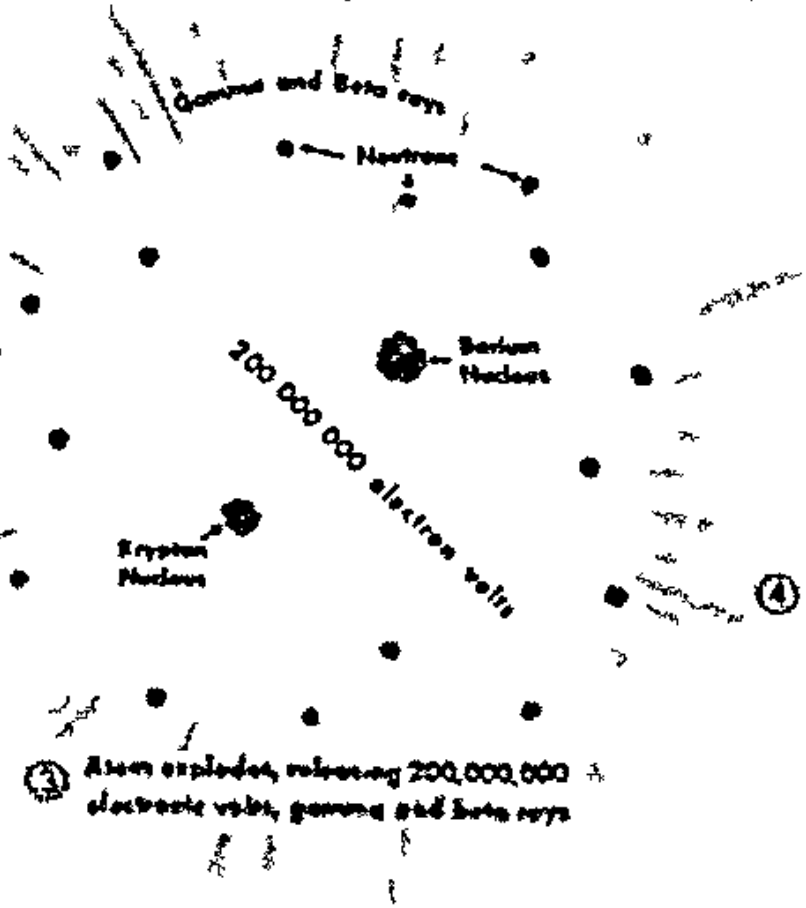
Breaking the Nucleus of the Atom



① U 235 Atom is bombarded by slow moving neutrons



② Neutron penetrates nucleus upsetting delicate structural balance



③ Atom explodes, releasing 200,000,000 electronic volts, gamma and beta rays





④ When the new barium nucleus and the new krypton nucleus get far apart, and everything is cool and quiet again, they both pick up the necessary electrons, which are always wandering around, to make normal atoms.

[illegible]

full share of electrons However once in a while this beautiful regular arrangement is disturbed If some outside influence such as a free roving electron comes along it may knock one of the outermost electrons of the atom slightly out of its regular orbit or traffic lane The free roving electron will get quickly out of the way like a hit and run automobile driver The atom will be left a little different from normal However very soon the elec tron which has been slightly displaced will jump back to its former place

When this happens the atom gives out light The light from one atom would be far too faint for our eyes to see but when mil lions of atoms behave in the same way at the same time the light can be very bright This is exactly what happens in a neon sign Roving electrons sent by electricity scurry through the neon gas in the tube and disturb numbers of atoms When these atoms return to normal which they do in a small fraction of a second the familiar red l ght is given out Because all the atoms are of the same kind and behaving in about the same way the neon light is the same color—red Every kind of atom gives out its own special kinds of light forming what is known as its spec trum In this way atoms can be identified by their light

In the above paragraph we have learned how an atom gives out light while returning to its normal condition after one of its outer most electrons has been sl ghtly disarranged by some gentle disturbance However an atom may be disturbed very violently for example by electrons moving at extremely high speeds Such high speed electrons occur naturally as a consequence of the cosmic rays which beat upon the earth from outer space They can also be produced artificially An X ray tube sends a stream of electrons moving at speeds between 50 000 and 180 000 miles per second When one of these electrons strikes an atom (for example in the metal target in the X ray tube) it is likely to dislodge an electron from the atom and will most likely dislodge it not from the outer shell but from one of the innermost shells

Now these shells are known by special names The one nearest the nucleus is called the K shell the next one the L shell the next the M Suppose one electron has been knocked out of the K shell The disturbance has been so violent that the electron is likely to be removed entirely from the neighbor hood of the atom What is left is of course an ordinary atom with one electron missing from the K shell

This absence of one electron gives the atom considered as a whole a positive charge of electricity The atom can not re main long in this incomplete condition any more than a good householder will allow a broken window to go unrepaired for a long time so the atom proceeds to readjust its supply of electrons Usually an electron from the L shell jumps into the K shell to plug the vacancy and then in turn one from the M shell goes over to fill the space in the L shell

When these electron jumps occur the atom gives out X rays which are really a kind of light only with a very much shorter wave-length than ordinary light Thus we see that the formation of that kind of l ght which we call X rays is not very much differ ent from the production of visible light as we described it in the case of the neon sign X rays occur when an electron makes a jump from one to another of the *inner* shells of electrons visible light is given out when an electron makes a very small jump in the *outermost* shells

But we have left the atom after rearrang ing its electrons in an incomplete state with one electron missing from its outermost shell How does it acquire an electron to complete its structure again? At all times there are always *free* electrons drifting around in a metal and even a few in the air The atom simply picks up one of these free electrons and thereafter continues a perfectly normal existence just as the good householder who has the broken window repaired

ENERGY FROM ATOMS

By **Gerald Holton**

YOU have learned that all matter is made up of tiny particles called molecules A rod of iron for instance is composed of iron molecules just as truly as a brick wall is built up with individual bricks And you have learned that each separate molecule is com posed of one or more atoms of which there exist in nature only ninety two separate kinds On page 45 is a list of all these differ ent atoms starting with the l ghtest hydro- gen and ending with uranium the heaviest and biggest If a substance is made up of

atoms of only one kind we call it an element

Let us look once more at the l ghtest element hydrogen Each of its atoms consists of two d fferent particles one is the rela tively heavy proton which is positively charged and is at the center of the atom and the other particle is the tiny and negatively charged electron that circles rapidly around the proton The center of the atom is called the nucleus

Helium the next heaviest atom is made of three different particles At the center the nucleus there are two protons and two other particles called neutrons and circl ng around these four are two electrons The neutrons are about as heavy as the protons but have no electric charge

The th rd listed atom has 3 electrons and 3 protons the fourth element has 4 electrons and 4 protons and so on down the list until we get to the last element uranium which has 92 electrons circulating around a nucleus that conta ns 92 protons and 146 neutrons

NATURE ALWAYS MIXES THE ISOTOPES OF AN ELEMENT IN THE SAME PROPORTION

Thus we find in general that each separate natural atom has as many (negatively charged) electrons outside the nucleus as there are (positively charged) protons in s de The number of neutrons in the nucleus is not so fixed For instance not all uranium atoms have 146 neutrons some have only 143 others only 142 Thus we find in nature three kinds or isotopes of uranium but the first is much more abundant than the other two

Now there are two remarkable facts about isotopes The first is that nature always mixes the isotopes of an element in the same proportions If you took an ounce of ordi nary uran um ore from anywhere in the world you would find that most of it con sists of atoms with a nucleus of 146 neutrons and 92 protons thus having 238 units of weight since protons and neutrons weigh the same and since the electrons outs de the nucleus are so l ght as to be almost negli g ble We call this kind of uranium U 238 But mixed with the U 238 in a lump of natu ral uranium are some of the isotopes weigh ing 235 and 234 units (one has three neu trons less than U 238 the other has four neutrons less) The isotopes are alway s mixed in these proportions 99 3 per cent of U 238 0 7 per cent of U 235 and about 0 006 per cent of U 234 These isotopes of the same element are difficult to separate from each other in the laboratory because they are all alike in their chemical activities

Another interesting property of isotopes of arious elements is that their nuclei are not equally stable In some isotopes when left all to themselves the atoms by and by all fall apart emitting (shooting out) some of their particles at great speed Such isotopes are called radioactive Others do not read ly d s integrate (fall apart) by themselves but are easily knocked apart if certain particles are shot into them from the outside You can learn about these interesting matters in the chapter on Radioactivity

Whenever an atom disintegrates into smaller pieces some of the matter of which the nucleus consists disappears completely and is converted into pure energy The amount of energy resulting from such a process is relatively large It is this so-called atomic energy which is responsible for the sun s radiation and for the power of the atomic bomb If it were possible to convert one pound of any matter entirely into elec trical energy you could run with it all elec tric apparatus in the United States for a whole month (This requires about ten b l lion kilowatt hours)

This method of creating atomic energy by destroying matter in an atomic nucleus d f fers radically from the usual process of ob taining heat energy by burning or combus tion which involves only a rearrangement of whole atoms and their electrons with respect to each other

We can now make a picture of the produc tion of atomic energy A lump of matter say uranium consists of uranium atoms of three kinds namely U 238 U 235 and U 234 Their nuclei cons st of 92 protons plus 146 143 or 142 neutrons respectively The nuclei of these various atoms are d stributed through the total lump l ke a cloud of stars in the sky 92 even smaller electrons make large and rapid circles around each nucleus Though every uranium atom has a tendency to be radioactive it would take billions of years before half the atoms in any small lump found in nature would disintegrate by itself Therefore we can assume here that our lump is fairly stable if left to itself

BOMBARDING AN ATOM WITH NEUTRONS IS THE WAY TO SMASH THE NUCLEUS ITSELF

Let us shoot into this cloud of atoms a very small particle say a proton It is about 1 850 times heavier than an electron and like the nuclei of the atoms themselves it is charged positively and as you know posi tive charges repel other positive charges

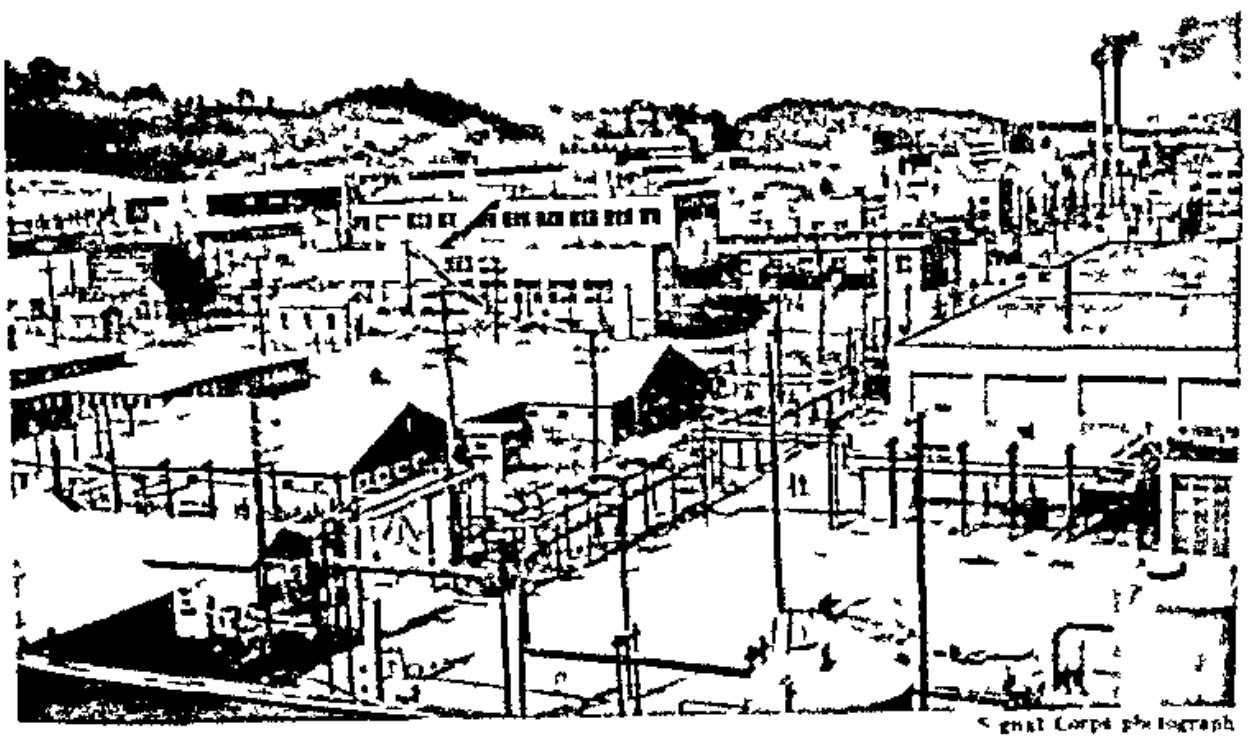
Therefore this proton will be repelled from any nuclei it may approach, and be turned aside, perhaps knocking a few electrons out of their regular path, as it goes by, until it has exhausted all its energy and is slowed down Hardly ever will the proton have a chance to collide with a nucleus

But if, instead of a charged preton, we fire an uncharged neutron into the atomic cloud, it is not repelled by a nucleus that may be in its path, and a ' head-on" collision is possible While, therefore protons and other charged particles can knock only chips off the ' surface ' of an atom, the neutron can get right inside and knock the nucleus itself apart This is called fission

This is the secret of atomic energy A neutron shot into a nucleus can smash the atom so that part of its mass is converted into pure energy and the remainder forms new atoms If a neutron having a little energy is fired into a lump that is mostly U-235, the following amazing thing happens The first nucleus hit will split into approximately equal parts, that is, fission occurs Each fragment of the old nucleus flies away at great speed and eventually settles down to form another lighter atom Several neutrons that were locked in the old U 235 nucleus have no place in these nuclei of the new atoms, they are free to shoot through the rest of the atom cloud around them They do so at very great speed because *during fission about one tenth of one per cent of the mass of the old uranium atom has been converted into pure energy* which shows up in the great speed of these flying particles

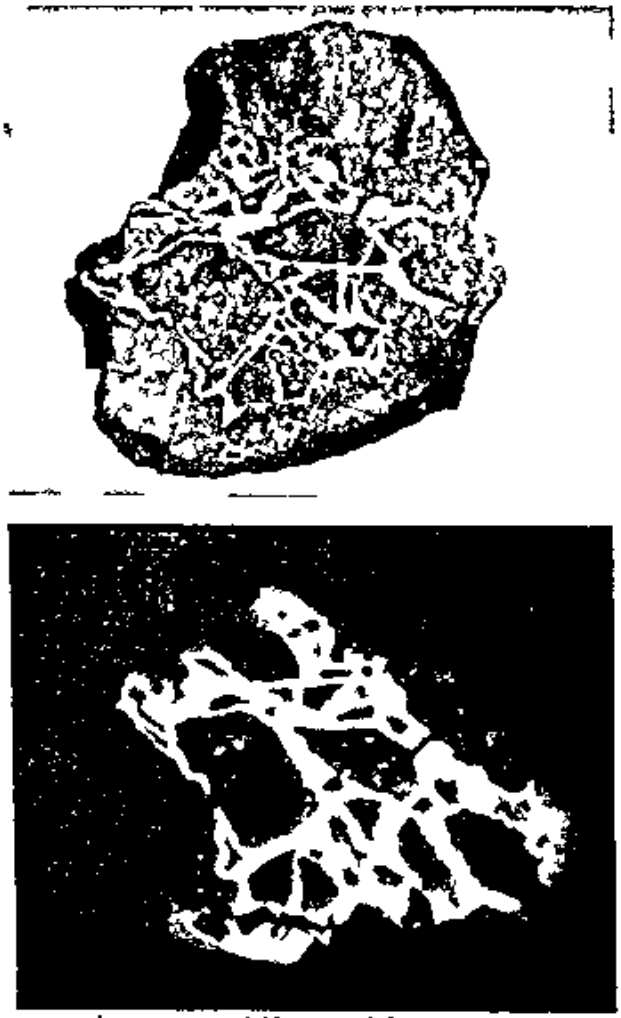
This explosion would not be noticeable by us if only one atom were set off But you can see readily that the several neutrons that fly around after fission of their mother atom may similarly set off other explosions all around them, this "chain reaction actually occurs in a lump of U 235 as used in one kind of the atomic bomb Within an incredibly short time most of the billions of billions of atoms in the bomb are thus ignited ' The total effect of this sudden release of enormous energy is an atomic explosion equalling in effect many thousand times that of the ordinary explosion of an equal lump of gunpowder or TNT

As far as we know now, this powerful "chain reaction ' occurs only in U 235 and



Signal Corps photograph

This is a production area in the Oak Ridge Tennessee atomic bomb plant. It is part of a government-owned and-operated city there Other research and manufacturing centers are in New Mexico and Washington State.



Department of Mines and Resources photograph

An exposed photographic plate shows veins of pitchblende (bottom) which run in natural rock (top)

in one other element called plutonium which has to be produced artificially This is the way plutonium is made Ordinary uranium ore, as found in certain portions of the United States northern Canada Czechoslovakia and the Belgian Congo and containing all three isotopes is assembled in one big pile weighing several tons The U 235 naturally present in the pile will produce the chain reaction we have discussed above but at a slow rather than an explosive rate because many of the neutrons produced by fission of U 235 are swallowed up by the U 238 without causing any fission there This keeps the atomic fire in the pile smoldering rather than breaking out into a big blaze

Actually the 'fire would go out altogether if two tricks were not used One is to insert within the pile some material like graphite blocks. Their function is to slow down the neutrons from the U 235 fission Why slow them down? Well it is a curious fact that these slowed-down neutrons are more effective in breaking up nuclei than are the high speed neutrons produced by fission

The other trick used to keep the chain reaction going in the pile is to build it so large that only relatively few neutrons from the inside can reach the edge of the pile and escape without having hit and produced fission in some other atoms of U 235 or at least having hit and become absorbed by some atoms of U 238 That is called the critical size of the pile In a pile below critical size so large a portion of the neutrons escape into the air before acting that the atomic fire will go out

In such a pile kept well supplied with fast flying neutrons by the chain reaction of the U 235 isotope the U 238 atoms may capture neutrons without their nuclei falling apart But then a curious thing happens to such a U 238 atom The captured neutron which makes the atom now weigh 239 units by and by seems to split inside the nucleus into a proton and an electron The tiny electron is violently pushed out of the nucleus But now the nucleus has 93 protons instead of the usual 92 of uranium Not long after that the same thing happens again in the nucleus (as though one tickle made the atom sneeze twice)—another neutron in the atom splits into a proton and an electron and the electron flies out leaving 94 protons and 145 neutrons in the nucleus This atom can of course no longer be considered uranium it is called plutonium It happens to act very similarly to U 235 If it is separated from the other materials in the pile that produces it and assembled into an atomic bomb like U 235 it too explodes with terrific violence by a chain reaction which spreads through the whole bomb material instantaneously

PLUTONIUM CAN BE SEPARATED AND CONCENTRATED MUCH MORE EASILY THAN U-235

You may wonder why anyone went to all the bother of producing plutonium (written as Pu 239) for atomic explosions when it can do no more than the natural U 235 can do The answer is twofold First it is very difficult to separate the isotope U 235 from U 238 since they are chemically alike but plutonium is an element chemically different from uranium and can therefore be separated and concentrated with greater ease And secondly as we have noticed before the amount of the U 235 isotope in a lump of natural uranium ore is very small compared to the amount of U 238 So it is more economical to convert the U 238 into plutonium than to extract the rare U 235 and discard the 140 times more abundant isotope U 238

Just as a pile for making plutonium will not begin to work until it has been built up to a critical mass or bigger so too a bomb made of U 235 or plutonium will not explode if its mass is below a critical size This fact suggested an ingenious way of detonating (setting off) the bomb namely, by suddenly joining small pieces of the explosive material (U 235 or Pu 239) each below the critical size but more than sufficient in size when put together to spread the destructive chain reaction through the whole bomb For U 235 this critical size is probably a lump of less than 200 pounds mass

Are there any uses for atomic energy besides the destructive ones? Luckily the answer is yes Famous scientists have predicted that not many years after man s first use of atomic energy in the form of bombs we shall have atomic power plants and atomic engines

At first we might just make use of the enormous quantities of heat that are liberated in the uranium and graphite pile during production of plutonium Actually about one million kilowatts of power can be expected from one such pile which is not far from the amount of power developed by a large size electric power plant Of course some kind of heat engine would be used to transform the heat energy in the pile into electricity or useful work

Later on perhaps in fifty years ways may be found to use atomic energy liberated in a chain reaction directly in engines much as gasoline fuel is now being used in combustion engines But before this can become possible a great deal of progress in physics and engineering will have to be made But there are other more immediate results of the research on atomic energy We have learned a great deal about the nucleus and its behavior which may open up new and better ways of using ordinary power generation Much has been discovered about new radioactive materials and their effects in human bodies and in chemical reactions this benefits greatly the fields of medicine biology and chemistry

What about the supply of fuel for atomic energy? Must we depend on uranium? We know that fission of single atoms can occur in several different elements but the production of larger quantities of atomic energy *depends on a self maintained chain reaction* of the material used as fuel and so far only uranium and uranium produced plutonium have shown this chain reaction Yet the known deposits of uranium could supply the total world needs of power for only a few scores of years!

Therefore we shall have to find other ways of generating atomic energy—for instance to try to induce chain reactions in more plentiful and available elements such as some of the metals Actually it is just such a process involving the nuclear interaction of carbon hydrogen nitrogen and oxygen which produces the enormous energies radiated by our sun and by other stars Part at least of the



British Combine photograph

Students look at the control board of the cyclotron (or atom smasher) in the laboratories of Cambridge University England



Photograph by Press Association Inc.

This picture was made three minutes after an atomic bomb hit the Japanese city of Nagasaki on August 8. The huge smoke column towered more than 20,000 feet in the air On the ground the blast reduced the city to dust.

heat in the interior of the earth which prevents its cooling and complete freezing over is also thought to be atomic energy liberated by radioactive elements

A third process in nature involving the kind of atomic fire that results from the destruction of nuclei is the spectacular explosion of stars which happens now and then A whole star seems to become suddenly a big atomic bomb and vaporizes part of its mass suddenly into light and heat

It may have been such a celestial explosion which guided the shepherds to the crib of the Prince of Peace the child Jesus in Bethlehem May we all succeed in making this new powerful tool of producing atomic energy a means of spreading peace and plenty to all men

AUSTRALIA

By **Lloyd Clarke**

BY far the most important event in the Australian calendar of 1945 was the coming of peace to the Pacific. And in Australia as in other countries, men and women turned their thoughts and their energies to the task of building a new pattern of living after almost six years of bitter war.

The year had seen rapid changes and advances for the Australians who were fighting the Japanese. The new year first brought news of a new Australian offensive. Its purpose was to clear out the 101,000 Japanese trapped in strongly defended pockets in Wewak (northern New Guinea) and in the islands of New Britain, New Ireland and Bougainville (Solomons). These Japanese forces had been by-passed in 1943-44 when General Douglas MacArthur began the spectacular series of thrusts that carried him to victory in the Philippines. The by-passed Japanese troops were no serious threat to the Allies' lines of communication, but there were many good reasons why they had to be eliminated. Australia felt also that she had an obligation to clear the Japanese from lands which rightly belonged to a friendly native people.

Consequently, the year began with four crack divisions of Australian troops engaged in a new campaign which brought fighting as bitter as any they had yet encountered. To many ill-informed people this struggle that was waged for eight weary months before peace brought an end to hostilities was purely a "mopping-up" operation. But in jungle warfare men seldom move on wide fronts as they did in Europe. For instance, in the narrow trails and deep ravines of the



Australia's new Governor-General. The Duke of Gloucester presents a Diploma to the Governor-General, Sir William McKell.



Aus al an offic al pl o ograph

Australians are famous fighters. A mortar crew in action with the enemy at close range Balikpapan Borneo

tropic jungle so perfectly suited to defense the battle to clear out the Japanese remnant became a costly inner war —a war inside the ever widening circle that marked our progress toward the final goal—Tokyo In New Guinea New Britain and the Solomons enemy casualties for the eight months were estimated at a m nimum of 28 000 most of them in fierce hand to hand clashes in wh ch the Australians lost one soldier to every four teen Japanese

Austral a s part in the war to defeat Japan was not limited to fighting the inner war Australian a rmen and sailors were in the forefront of the Battle for the Phil ppines On May 1 came news that battle-seasoned Australian troops had stormed ashore on the oil rich island of Tarakan off the coast of northeast Borneo This sudden and unex pected thrust drove right at the heart of Ja pan s criminally gained empire of conquest This attack was quickly followed by an inva sion of the Borneo mainland From the east and the west Australian soldiers hemmed in the enemy and caused him to flee to the north to the south and to the inland hills where Royal Austral an Air Force bombers and fighters strafed him mercilessly Al though the Japanese fought stubbornly in Borneo the fiery fanaticism that had marked their earlier campa gns was dying A few weeks before the Japanese surrendered the Australian commander Lieutenant General Sir Leslie Morehead was able to announce that all the first objectives of the Borneo campaign had been secured

While men were fighting setting the stage for the final defeat of Japan other men at San Francisco were setting the stage for peace Australia was represented among the fifty nations which met there in conference to draw up the security charter Australia s delegation was led by Deputy Prime Minis ter Francis Forde and External Affairs Min ister Dr Herbert V Evatt They made two important contributions to the debate The first was their leadership of a bitter opposi tion to the veto powers which the United States Britain Russia China and France sought to impose So ably was the Australian case presented by Doctor Evatt that he be came known as the leader of the l ttle 45 " as distinct from the well known Big Five the powerful countries which might other wise have unduly swayed proceedings Aus tral a s second contribution one which was finally adopted concerned the embodiment in the charter of the principles of full em ployment Long before the San Francisco Conference the Australian Government had committed itself to a pol cy of full employ ment This proposes simply that each na

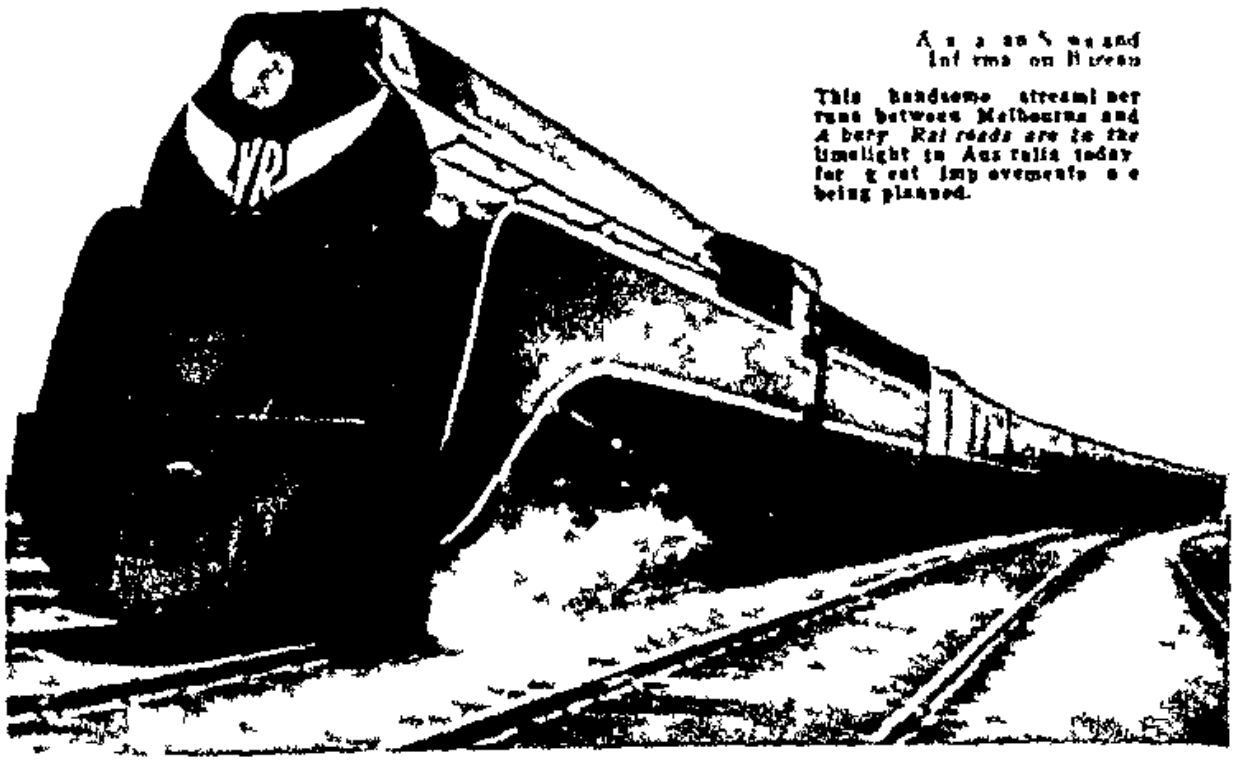
tion should take upon its own shoulders the task of insuring that its own natural resources shall be developed to the full By doing this, it is believed that employment will be provided for all living standards will be improved and a fuller enjoyment of life made possible for everyone In short it was Australia s plan to achieve the second of the famous freedoms outlined in the Atlantic Charter— freedom from want

And so with this policy as her guide Australia began to prepare for the difficult period that must follow the change-over from war to peace The National Works Council announced its plan to provide 4 000 separate post war projects These will put the government s policy of full employment into effect in a practical way The most ambitious of these projects was a scheme for the unification to standard gauge of the entire Australian railroad system Perhaps it would be a good idea to explain just what that means

You know that Australia is a vast island continent whose land area is just a little less than that of the United States This huge land area is divided into six states each of which has an elected Parliament to administer its domestic affairs In the early days of railways, communities were small and scattered and there were no companies prepared to put sufficient capital in so risky a venture as a railroad So each state government undertook the task of constructing its own railroads When each state had completed its system New South Wales and Western Australia had gauges (width between rails) of 4 feet 8½ inches Victoria had 5 feet 3 inches and Queensland had 3 feet 6 inches South Australia which lies between Victoria and Western Australia had both 5 feet 3 inch and 4 feet 8½ inch gauges These variations in gauges have caused great expense and loss of time because goods have to be changed from train to train at most state borders And so the National Works Council a body on which each of the six state government leaders has a place has now decided to proceed immediately with the colossal task of unifying the gauges to 4 feet 8½ inches The preliminary steps alone are expected to take eleven years to complete and will cost at least $ 47 000,000

Four events of political significance occurred during 1945 in Australia The first of these was the arrival of the Duke of Gloucester brother of King George VI to take up duties as governor-general of Australia The second was the tragic death of Australia s greatly loved wartime prime minister John Curtin The third was the election of Joseph Benedict Chifley as prime minister The fourth was the announcement of the Australian Government s extensively planned immigration policy

In recording the Duke of Gloucester s arrival as governor-general it might be well to



Australia and Information Bureau

This handsome streamliner runs between Melbourne and Albury Rail roads are in the limelight in Australia today for great improvements are being planned.

explain what his functions are and how Aus tralia stands in relation to the British Crown The Governor General of Australia is George VI s direct representative in Australia It is not always easy to understand just what re sponsibility that involves Australia is a free and independent member of the British Commonwealth of Nations Perhaps the best parallel to the King s position is that of the president of many companies each of which is independent of the other When he sits as president of any one company he is guided by the vo ce of the shareholders in that con cern So it is with the King Although he is the president of both England and Aus tral a when matters concerning Australia are before him he must be guided by the voice of his Australian ministers No law passed by the Parliament of Britain can have any authority over the people of Australia That is why a governor general does not gov ern but becomes the personal representative of the king in the councils of the Australian people

The late prime minister John Curtin was a widely respected and beloved leader He directed the complete war mobilization wh ch won Australia such renown among the nations of the world He died quietly in his sleep on July 4 at the prime minister s offi cial Canberra residence H s death followed a general illness wh ch had persisted s nce November of the prev ous year One of the first people notified of his death was Presi dent Harry Truman President Truman s comment on his passing was He brought to the public service of his country not only a great ability and integrity but a deep sense of loyalty to the principles which guided the United Nations through the war so victori ously ended in Europe and so successfully waged in the Far East General Douglas MacArthur with whom he had been inti mately associated referred to him as of the great of the earth



Aus ral an News and Information Bureau

John Curtin (left) and Joseph Benedict Chifley

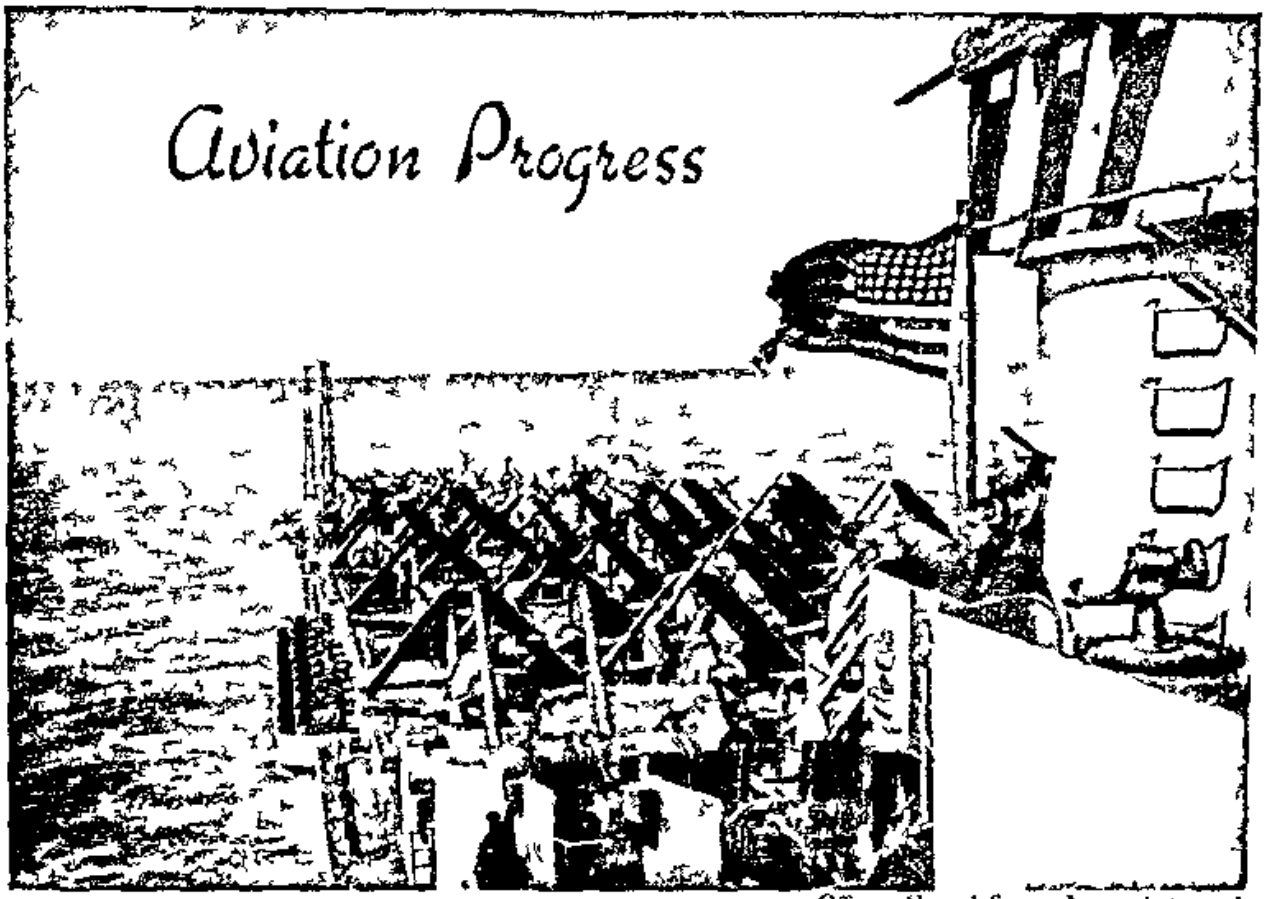
AUSTRALIA S NEW PRIME MINISTER JOSEPH BENEDICT CHIFLEY

John Curtin was followed in office by Jo- seph Chifley who was elected leader of the Federal Parliamentary Labor party the Government party on July 12 1945 His ele vation to the post of prime minister climaxed nine of the most incident packed days in Australian parliamentary history for in that time Australia had three prime ministers— Curtin Deputy Prime Minister Francis Forde who acted in office until a new party leader was selected and finally Joseph Chifley Chifley who was Federal Treas urer in Curtin s Cabinet began life as an apprentice in the New South Wales state railroad service and had risen to locomotive driver when he left the footplates for politics

One of the first appointments made in the new government was that of a Minister for Immigration The newly appointed minister Arthur Augustus Calwell who is also Minis ter for Information followed his appoint ment with an important announcement about Australia s immigration plans He con firmed the Government s intention to raise the popula on from 7 300 000 to 20 000 000 by the swiftest poss ble means He added however that the Government will not em bark on any large scale immigration pro- gram until its own house has been set en tirely in order By this he meant that when the Austral ans in the services and those who had gone to other forms of essential war work were once again settled in normal liv ing the door would be opened for others to come in

The Government is looking to Europe and the United States for the bulk of its immi grants and has permitted hundreds of Amer ican and British service men and women to take their discharges there First step in the plan will be to bring out 54 000 British war orphans who will be schooled and trained for work and living in Australia They will be taken to Australia at the rate of 17,000 a year in the next three years

Aviation Progress



Official United States Navy photograph

Hellcat and Helldiver warplanes grouped on the deck of an aircraft carrier The wings are folded to save space

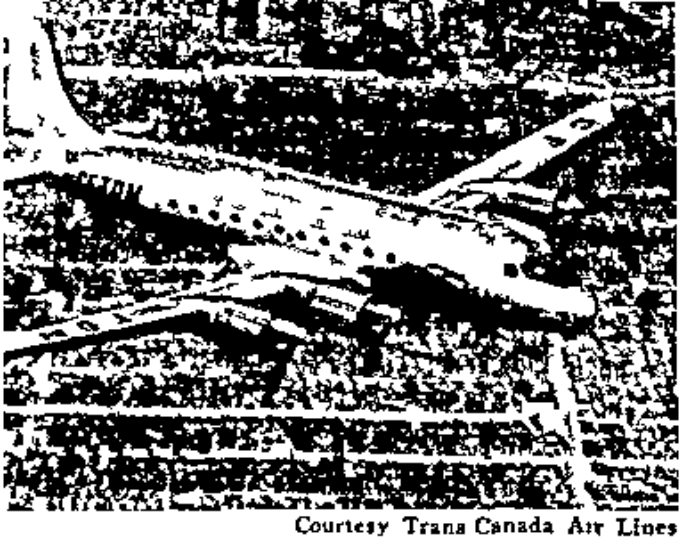
By John Paul Andrews, *Executive Editor, Air News Magazine*

SOME day we shall fly peacefully on the power that destroyed Hiroshima and Nagasaki But that day is almost certainly a long way off For one thing atomic energy is not likely to be used in existing airplanes and airplane engines designed as they are for more commonplace methods of propulsion And as you know scientists inventors and engineers have a long way to go before this energy can heat our homes fly our planes or power our automobiles

So let us consider the airplanes which are already flying and not so much those of an age to come It is the planes that are in the air and in the factory now that we shall know in the next few years It is these planes that will be the victors over time cost and danger in opening a new era of mass world circling transportation

It is interesting to look back a few years in order to obtain a true picture of aviation s advance Before Pearl Harbor the twin engined Douglas DC 3 and the Lockheed Lodestar transport planes—just about all of aviation to the common observer—traveled through the air at speeds of about 175 miles an hour Air battles, however are won and lost in minutes not hours So all the fighting nations designed and built military planes for more speed and then still more Engines were improved made bigger improved again Designs became aerodynamically more efficient planes were cleaner (resistance to wind decreased) and smoother so that all of them slid through the air with an ease undreamed of just five years before

The 300-mile an hour mark flashed by then the 350-mile-per hour speed Finally at the war s end Allied fighter pilots were flying and fighting at over 425 miles per hour in planes such as the Republic P 47 Thunderbolt the North American P 51 Mustang and the British Hawker Typhoon The big fellows went right along with their smaller brothers Boeing Aircraft Company engineers developed the Boeing Stratocruiser from her wartime twin the B 29 Superfortress The Martin B 26 Marauder gave rise to its transport relative, the Martin 202 The Douglas C 54 Skymaster became the commercial DC-4 and had a new sister in the fifty-six passenger DC-6 Lockheed s C 69 Constellation replaced cargo space with seats and made ready for the eager onrush of travel



Courtesy Trans Canada Air Lines

Scheduled for overseas and domestic use by Trans Canada Air Lines this forty passenger air liner is a version of the C 54 Skymaster military transport

hungry passengers All these planes fly faster, farther and more economically by far than their pre war ancestors And they are flying now The greater things ahead are unpredictable Why even now a plane with wings longer than an entire football field is being built It is the Hughes Hercules, a mammoth wooden flying boat, capable of carrying 300 passengers or transporting as cargo Glenn L Martin's big plane, the Mars!

Progress in air speeds went so far, and then it came to a temporary halt Propellers could absorb no more power even though engines had grown to twice their pre war size Until planes without propellers were designed aviation was held at about the 500-mile-per hour level Then came jet planes, which were built to fly without propellers

All of us are familiar with skyrockets Military rockets have been in existence for a long time Francis Scott Key wrote of "the rockets' red glare' in 1814 But man carrying rockets had never been attempted until Dr Robert H Goddard began experiments in 1930, at almost the same time as the announcement of Baron Fritz von Opel's rocket powered airplane in Germany Rockets, however, burn away their fuel as they fly A new type of engine was needed, one that could operate on a more satisfactory fueling basis so that longer trips would be possible And that was the beginning of jet propulsion, where the end will be nobody yet knows

Scientists and engineers learned how to draw air into the nose of an airplane or automobile, heat this air to increase its pressure, then release it through the rear end of the vehicle Here was a means of making planes move along at tremendous speeds Inventors also learned that speed increases as a plane climbs higher and higher above the earth, where the air is less dense and offers less resistance to the movement of any object

To understand the principle of jet propulsion, one needs only to puncture a toy balloon with a pin As the air is released through the tiny hole, the balloon moves rapidly in a direction opposite to the pinhole The speed at which it moves depends upon the pressure of the air within the balloon itself before the hole is made the higher the pressure, the greater the speed And, for a given volume, warm air exerts greater pressure than cool air In a jet plane the engine is really used only to do this necessary heating the rush of gases out the back of the plane produces the forward thrust

It was this demand for tremendous heat which first handicapped the jet plane engineers To build the fans which force the hot gases out the rear of the plane an unusual metal was needed It had to withstand terrific temperatures, produced by burning kerosene—the common jet fuel Here American engineers took over the projects which had begun in England Using turbines, or large blowers, originally developed as superchargers for Flying Fortress engines, the engineers greatly increased the efficiency of Great Britain's Whittle jet engine The result was the first American jet airplane, built by the Bell Aircraft Corporation and known to the United States Army Air Forces as the P-59 Airacomet From the lessons learned with this airplane a newer and better type was developed, the Lockheed P 80 Shooting Star It was the first American plane to approach the speed of sound

PLANES WHICH TRAVEL AS FAST AS SOUND HAVE LONG BEEN THE GOAL OF ENGINEERS

Sound, as you know, travels about 750 miles per hour The speed of sound, known as sonic speed, has always been the goal of most aviation engineers The jet plane most nearly approaches this speed now and, with further refinement, may some day lead to the desired goal

In 1944 a jet airplane flew from Los Angeles to San Diego, a distance of about 125 miles, in just over twelve minutes That means it traveled approximately 600 miles an hour Late in 1945, a British jet plane averaged more than 600 miles per hour in *five hops over a measured course Beating* the sun from New York to San Francisco or from Quebec to Vancouver may become quite the customary way to travel before long Imagine leaving Washington at nine o'clock in the morning and arriving in Los

Angeles at eight fifty nine the same morning

But jet propulsion is hardly more advanced than regular engines were when the Wright brothers made their first flight. We have only indications of what we shall accept as a regular thing five or ten years hence Most aircraft engineers now picture 1 200 mile per hour speeds as commonplace within ten years If their forecasts prove accurate we shall some day fly from New York to Chicago in forty five minutes from New York to London in less than two hours from Montreal to Rio de Janeiro between lunch and dinner, or around the world in less than a day

THE AVERAGE PRIVATE OWNER WILL NOT HAVE A HELICOPTER FOR SOME TIME

The straight up-and-down airplane known as the helicopter is another miracle of progress It has been said that every airplane inventor from Leonardo da Vinci to the present has tried to perfect this type plane Recent years, however have seen the first measurable success in the helicopter field Able to rise directly upward to descend from any altitude into a space little larger than the average lawn to hover or stand almost still in the air for long periods of time the helicopter is as versatile as a bird Helicopter owners will never be limited in their travels by the scarcity of airports because any small clearing will give them safe haven

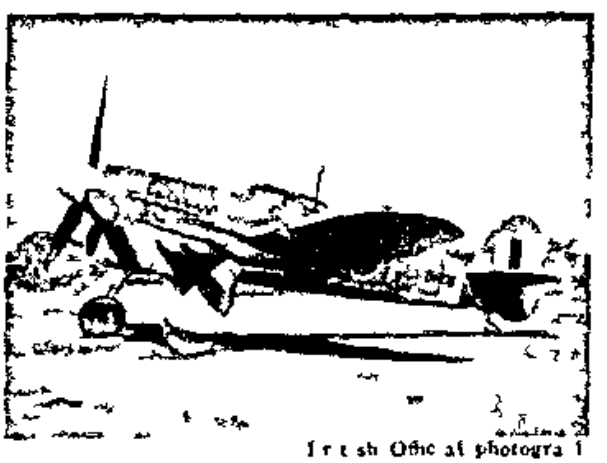
Unfortunately helicopters are still very expensive They carry only a few people and are somewhat slower than low-cost standard planes They are at the same time difficult to master Pilot training for a helicopter lasts as much as 100 hours where regular airplanes can be flown safely after less than 10 hours of instruction The helicopter will appear this year or next year on commercial operations carrying mail or farm produce to remote areas and moving cargo from cities to suburbs. However it will not become available to private owners until mass production brings low prices

The private or personal airplane now ranks as the most important item in our aviation industry s future Costing little more than a medium priced automobile these planes will carry two people and a fair amount of baggage at speeds exceeding 100 miles per hour, and over distances of 500 miles and more without re fueling They will use less gasoline and oil than a small automobile and will be expensive only in fixed charges like insurance and storage Several types have been introduced which are driven like automobiles and are just as safe It will be many years before every family owns an airplane but some 350 000 people will own their own planes within the next three years

During the war airplanes were designed to land and take off in as small a space as possible This improvement will make a great change in many new airports Some of them can be very small and still be practical and useful

Prior to 1941 fewer than 300 American cities had airports large enough to take advantage of air line travel But with more and more communities adding landing facilities and with aircraft advances that permit smaller areas for landing and take-off regular air service will become available to over 3 000 towns and cities in the United States Canada too and Mexico are advancing to establish a vast network of North American airports Most of these will be simple clearings on the outskirts of towns Many will be located right in the heart of large cities Only a few will be large enough to accommodate the new commercial air liners But all will be links in a never ending chain which will tie people and places together

In 1940 there were fewer than a dozen air lines operating from one country to another Today there are more than fifty The planes of these companies will carry the flags of fifty four countries They will crisscross the globe in air routes so complicated that every important city on the face of the earth will be within sixty hours of your home town In some ways this new world wide aviation is a result of the war, because the United States Army Air Forces Transport Command and the Royal Air Force Transport Command built most of the airports and installed most of the equipment at remote corners of the world But in other ways world air transpor



Brit sh Offic al photogra h

The Hawker Typhoon one of Britain s best fighters.

tation is a direct outgrowth of a desire for permanent peace on the part of the United Nations

CANADA'S SUGGESTIONS FOR A WORLD AVIATION POLICY ARE DISCUSSED AT CHICAGO

When Pan American Airways one of the original and best known world wide companies first sought air routes in foreign countries it dealt directly with foreign governments From them Pan American obtained landing privileges and other concessions necessary to long distance flying The air was free but the land was not With fifty four countries planning entry into commercial aviation it was absurd to think of each separate air line dealing with so many governments An official policy was needed to control air commerce That policy was born at Chicago in November 1944 when fifty two nations sent delegates to the International Civil Aviation Conference called by the United States State Department

At this conference Canada suggested that the governments form an organization which would control air worthiness of planes pilot fitness and similar standards At the same time they would authorize a non government association of air line operators to settle the question of fares and routes as private business men

Most of us have heard of the famous Four Freedoms which grew out of the Atlantic Charter You may also have heard of the two freedoms and five freedoms of aviation decided upon at the Chicago conference But not many people seem to know what these latter freedoms are

The nations which accepted the two freedoms agreed to permit planes from other nations to fly over their territory in innocent flight and to land for fuel emergency and other non revenue purposes In other words a British airplane from Bermuda may cross over New York Vermont or Massachusetts on its way to Canada—the first freedom —or it may land at New York City if weather engine trouble or fuel shortage recommends a stop—the second freedom Fewer than half of the participating nations have so far accepted this document

The third freedom allows planes of one country to discharge passengers in another country The fourth freedom permits a plane to pick up passengers in a foreign land for the journey home And the much discussed fifth freedom would allow the planes of one nation to pick up passengers in another country and discharge them in a third country In other words an American plane would be allowed to take on passengers at London and discharge them at Stockholm

Thirty seven nations accepted the basic Chicago agreement which established a temporary international air organization, known as the Provisional International Civil Aviation Organization Great steps have already been made toward solution of the two freedoms and five freedoms problems and it is more than likely that a compromise will soon be reached to give travelers fast cheap comfortable air service to every corner of the world

In the meantime aviation in the United States Canada and Mexico provides continually improving service to more and more people There are many air lines serving American Canadian and Mexican cities To know aviation one should know the names of the major lines as well as the regions which they serve

FOUR TRANSCONTINENTAL AIR LINES NOW OPERATE IN THE UNITED STATES

In the United States at the present time four air lines operate from the Atlantic coast to the Pacific coast The oldest of these is United Air Lines It cuts directly across the North American continent from New York to San Francisco over the more or less straight line route first used by the Government's air mail pilots a generation ago United has been flying this route since 1928

Once known as the Lindbergh Line Transcontinental and Western Air Inc., was the second cross country air line to carry passengers Its routes originate in New York and run diagonally southwest to Kansas City and Texas then angle northwest to Los Angeles

American Airlines Inc. the largest of all domestic United States air lines was the third company to offer transcontinental service One of its routes runs southward from New York to Washington D C angles southwest through Tennessee to Texas then follows a fairly straight line westward to Los Angeles Like United and TWA American has been operating for more than ten years as an important link between coasts

The most recent addition to the coast to-coast American network is Northwest Airlines Inc Inaugurated in 1926 as a regional air line serving the rich agricultural states of the middle western United States Northwest in 1945 received permission from the Government to fly directly from Minneapolis to New York As a result, Northwest now

operates across the continent flying from New York to Detroit thence to Minneapolis and then directly west to Seattle

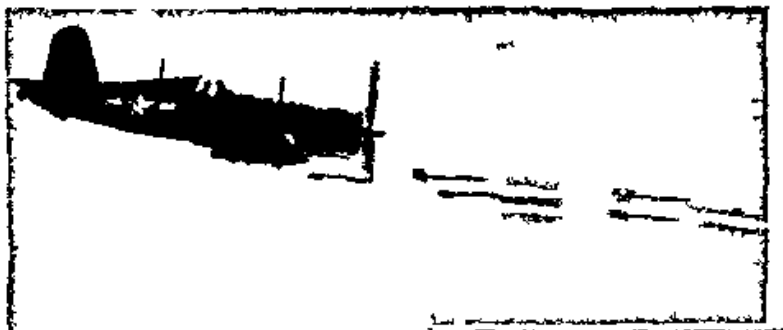
Turning from the cross-country to the regional air lines in alphabetical order we have

All American Aviation This organization has its headquarters at Wilmington Delaware and operates a unique air mail pick up service among the smaller cities of Pennsylvania West Virginia Ohio and New York

Braniff Airways The main offices and hangars are located at Dallas Texas It serves the cities lying between the Gulf of Mexico and the Great Lakes in an area roughly bounded by the Mississippi River on the east and the Rocky Mountains on the west

Chicago and Southern Air Lines The area served is aptly described by the company name with routes extending from Chicago and Detroit on the north to Louisiana and Texas on the south

Colonial Airlines This company has but one main route but its operations on that run between New York and Montreal have won a patronage challenged by few of the

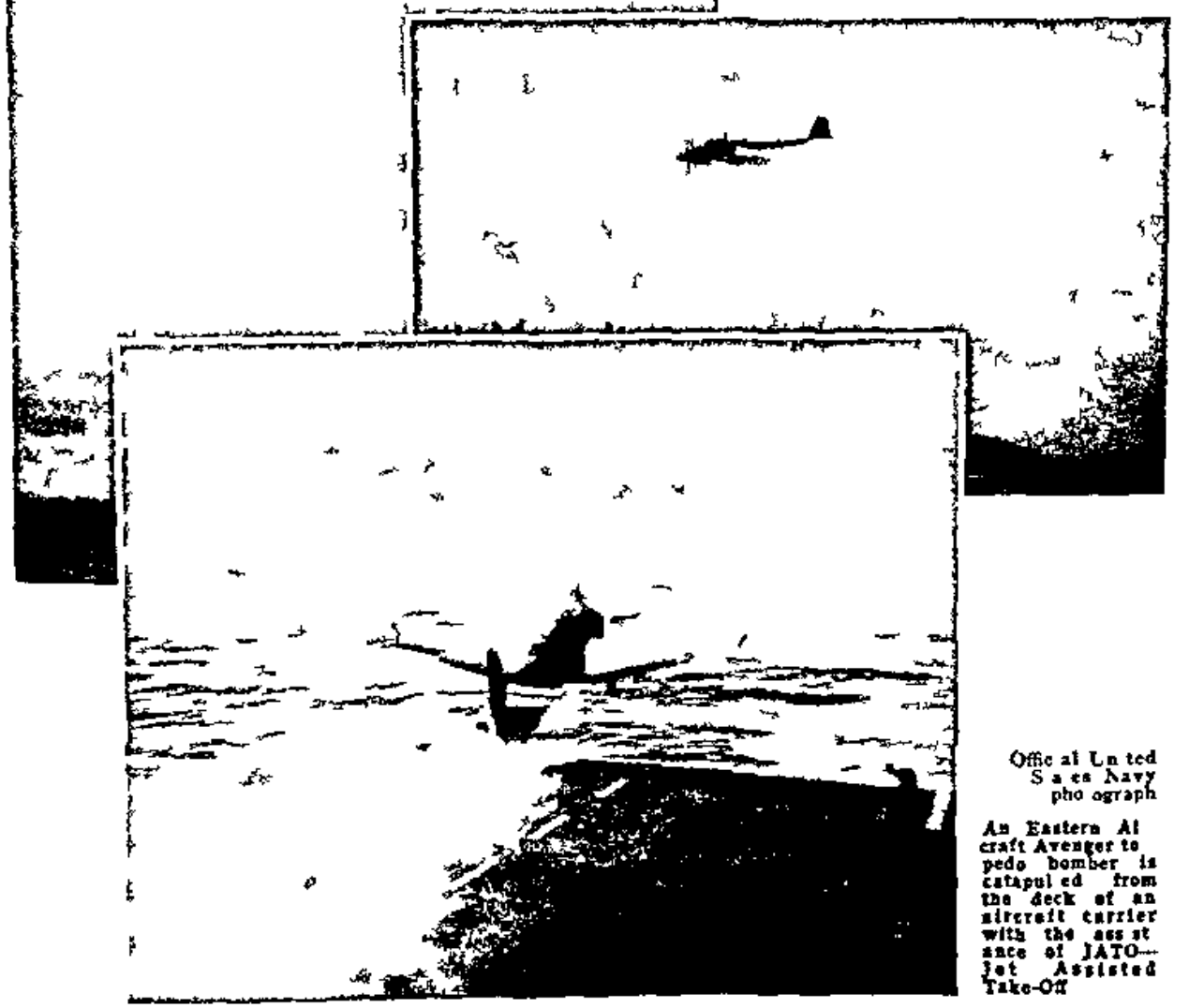


Official United States Marine Corps photograph

A Vought Corsair fighter plane fires its load of rocket projectiles at a Japanese stronghold on Okinawa

Official United States Navy photograph

Japanese suicide plane goes down in flame before the accurate firing of anti aircraft gunners



Official United States Navy photograph

An Eastern Aircraft Avenger torpedo bomber is catapulted from the deck of an aircraft carrier with the assistance of JATO—Jet Assisted Take-Off

larger air lines In recent months Colonial has begun a new Ottawa Washington service to give government officials of the United States and Canada a fast travel way between capital cities

Continental Air Lines Operations are based at Denver Colorado planes fly a rough square in the Great Plains states with corners of that square at Denver Kansas City Missouri Carlsbad New Mexico and San Antonio Texas

Delta Air Lines Started in 1927 as a crop-dusting service th s line cuts sharply across the southern United States between Texas and South Carolina with the main l ne cut in two by a heavily traveled route to Cin cinnati

Eastern Air Lines Headed by Eddie Rick enbacker America s greatest flying ace in World War I its headquarters are at New York City It runs from New York to Florida on a direct north south route and to Texas on a diagonal route

Mid Continent Airlines One of the small est air services it follows the Mississippi River in a north south d rection carrying passengers from Minnesota and the Dakotas to Louisiana

National Airlines Its 2 000 mile route serves all Florida cit es New Orleans and New York City

Northeast Airlines This company operates in the region which its name describes The routes extend from New York City on the south to Montreal and Moncton in New Brunswick on the north

Pennsylvania Central Airlines This line is unique in that it serves more state capitals than any other line in America It operates in the great industrial region bounded on the north by the Great Lakes on the east by the Atlantic Ocean on the south by the Ozark Mountains and on the west by the Missis sippi River

Western Air Lines With its Inland Air lines subsidiary, Western connects the big cities of California with the thinly settled states of Idaho Montana Wyoming and South Dakota on a route which fans out from Los Angeles to San Francisco on the north to the Canadian Rockies on the north west to South Dakota on the northeast and to Colorado on the east

Canada has two major air lines Trans Canada Air Lines began operation in 1937 with its 122 mile Vancouver to Seattle flight It has s nce expanded to include coast to-coast travel of over 5 000 miles from St. John s Newfoundland to Vancouver and Victoria in British Columbia

Canadian Pacific Air Lines came into be ing in early 1942 by consolidation of several Canadian air transport companies Its routes run northward like arteries from the ma n east west lines of communication into Labra dor northern Quebec northwestern Ontario the Prairie Provinces Northwest Territories British Columbia the Yukon and the shores of the Arctic Ocean They connect with Trans Canada Air Lines and the leading air lines of the United States

In Mexico there are a number of small lines with largely local service and a few big companies which provide the connecting links from Mexican cities to the United States Cuba Central and South America The latter include Compania Mexicana de Aviación (Pan American World Airways) American Airlines de Mexico Aerovías Bran iff Compania Mexicana de Aviacion Ser vicio Aereo Panini and Taca de Mexico

These are the air lines of North America at the moment The coming years may see fewer individual companies as routes and organizations are joined together However aviation s true growth will be measured more by the number of communities and people it serves than the number of air lines operating

Meanwhile the airplane which was born for peaceful use in 1903 has finally come of age as an instrument of that peace It will probably never again serve the military forces as it has in the past because the a r war of tomorrow promises to be largely a conflict between pilotless rockets and rad o controlled atomic bombers Using the air plane peacefully however, can indeed further the efforts of a peace loving world

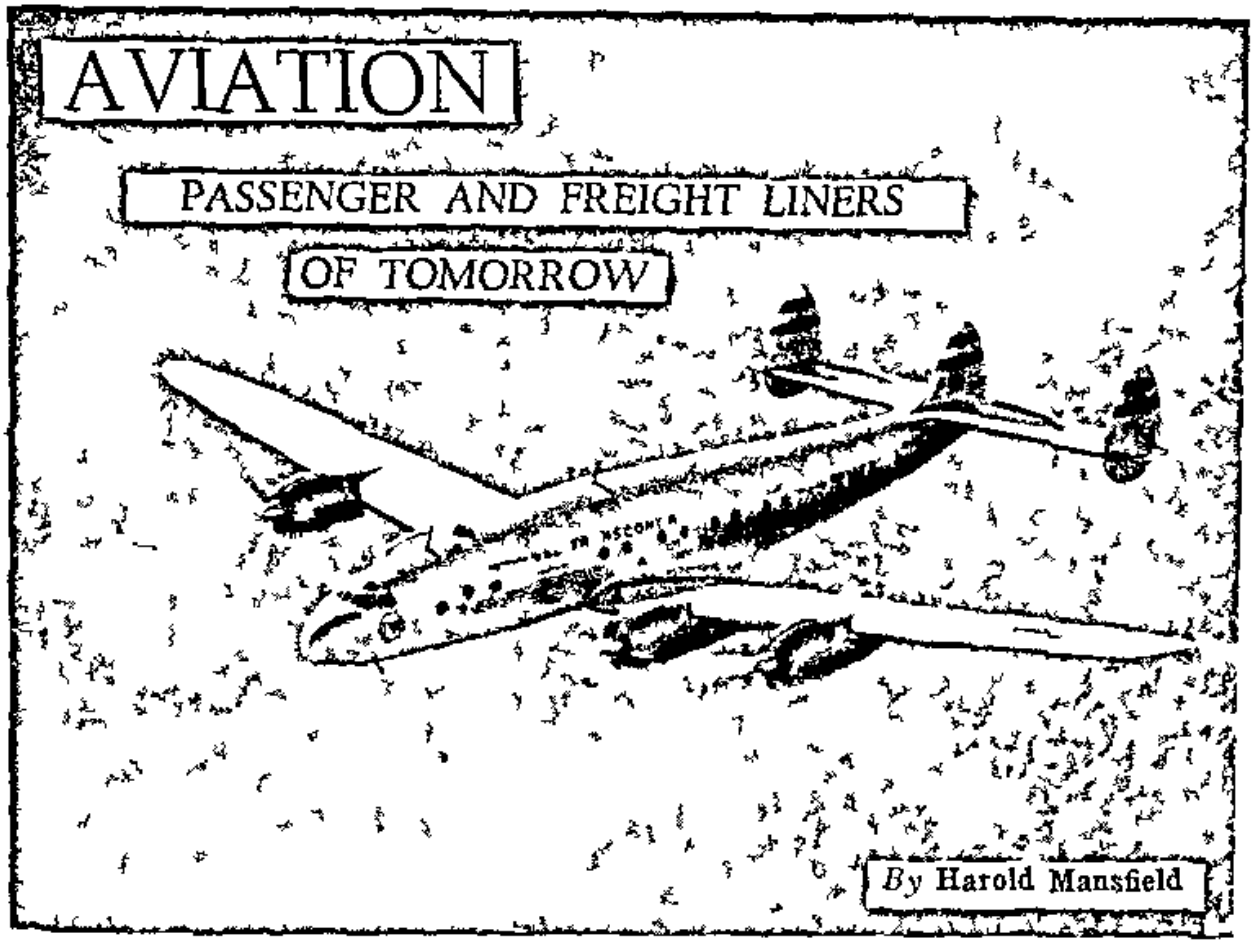


Free Lance Photographers Guild

The Republic Seabee an amphibious type private plane, seats four and sells for about $4 000

AVIATION

PASSENGER AND FREIGHT LINERS OF TOMORROW



By Harold Mansfield

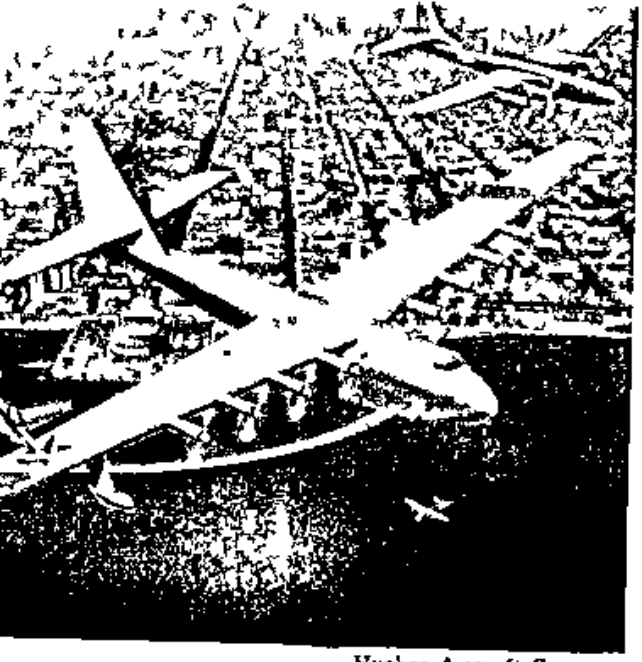
From coast to coast in ten hours is the timetable followed by this TWA Lockheed Constellation

THROUGHOUT the war people looked forward to the promised age of flight which would come as a result of the widespread use of aircraft in wartime. Now the age of flight is here. Already more people than ever before throughout the world are thinking in terms of traveling by air; they are sending their mail by air and sending their packages by air instead of by ground methods of transportation. The reason why people are expected to take to the air in larger numbers than before the war is that there will soon be more air liners available, operating more trips per day, landing and taking off at more cities and towns than ever before. Planes will make their trips much faster than did previous airplanes. The air line ticket will cost less than it used to cost. And more important, scheduled trips will be carried out with complete reliability even in bad weather.

The airplanes that will make all this possible are now being built, and some of them are already built. They will not be so different from previous airplanes in general appearance except that some of them will be much larger than customary air line transports. The big differences will be in things unseen—engineering improvements and new developments that were perfected for military use during the war will gradually become available for all transport airplanes operating in the peacetime world.

Greatest of all these developments is radar, the electronic equipment that enabled bombers to see their target despite dense clouds, that enabled warships to see attacking fighters approaching in the night or through heavy weather, and enabled military airplanes to take off and return again in thickest fog. Radar will be applied to commercial aviation just as soon as the equipment can be installed at airports and on passenger liners.

Radar, as you know, operates by sending out very short radio waves and then recording their echo as they bounce back from the land below or from the objects ahead. Echoes have long been useful for navigating in fog. The ship's whistle blows, then the men locate the shore by listening to the echo of the whistle. In the case of radar we get an electrical echo, and at such a rapid rate that it is actually possible to form an



Hughes Aircraft Company

The Hughes H-4 is the world's largest airplane It is designed solely to carry freight. Here we see a B 29 and a P-51 Mustang shown for comparison

image, or instantaneous picture, of the objects that are being 'viewed' through the fog

Radar will mean a great deal to air transportation Bad weather will no longer limit flying By using various types of radar and other electronic equipment, it will be possible for the air liners of tomorrow to approach the airport through thick fog rain or snow, and to glide down a clearly marked (though invisible) path to the landing runway It will be possible for airport operators to scan the overcast skies and see all the airplanes approaching the field on a radar screen although they are invisible to the eye With special equipment it will be possible for air liners to see other planes near them in the sky, and to see mountain peaks or tall buildings in their path although these obstacles are veiled by fog and clouds When such equipment is fully installed it will mean that air line transports can fly on planned schedules throughout the day, and day after day throughout the year, regardless of the weather

The new air liners will have other important safety advantages Their wings and tail surfaces will be internally heated so that when they fly through snow or sleet no ice will form on them On previous airplanes, ice forming on the wings has been knocked off by means of rubber tubes placed along the front edge of the wing and periodically filled with air But with heated wings the ice cannot form at all

Many of the new airplanes will have reversible pitch propellers After such a plane has touched the ground the propeller blades can be turned so that they push the air forward instead of backward, quickly bringing the airplane to a stop If there is snow or ice on the airport runway, and use of the wheel brakes might tend to make the airplane skid, these new "propeller brakes" will provide a simple means of bringing the big transport to a stop

The new ships will have improved instruments to aid the pilot and co pilot in flying and landing One of these is the 'true altimeter' which tells the distance from the ground at all times with a strictly accurate measurement to within a few feet

The big transports of tomorrow will be able to fly at very high altitudes, above all normal storm clouds, where the air is smooth And they will have long range so that even when storm clouds are extremely high the pilots can easily detour around them

Thanks to wartime developments of military airplanes, the air liner of tomorrow will be faster—so fast, in fact, that most normal long distance trips can be made in a few hours during daytime without the necessity of going to bed in berths at night Here are just two examples of the high speed of some of the newest transport airplanes the Lockheed Constellation, in 1944, from Los Angeles to Washington, D C, in 6 hours, 58 minutes, an average speed of 330 miles per hour, and the Boeing C-97 Army transport in January, 1945 from Seattle, Washington to Washington D C, in 6 hours, 4 minutes an average speed of 383 miles per hour (The Boeing C 97 is the military version of the Stratocruiser air line transport) These were speed flights but even in normal air line operations, planes like the Stratocruiser could make the 2 454 mile flight from Seattle to New York in less than 9 hours, with a stopover in Chicago From New York to London would take about 11½ hours of flying time From San Francisco to Honolulu would take 8 hours from Chicago to New York, 2½ hours from Seattle to Shanghai China, by way of Alaska, less than 19½ hours flying time

THE QUIET AIR-CONDITIONED TRANSPORTS OF TOMORROW

Air passengers will find the new transport planes almost as comfortably furnished as their living room at home This will be especially true of larger air liners, such as the Douglas DC-6, the Lockheed Constellation, the Boeing Stratocruiser and the huge Consolidated Model "37" Improved sound proofing will almost silence the sound of the

mighty engines outside the cabin Cabin su*perchargıng or high altitude air condition*ing will keep the cabin ventilated with nor mal atmosphere, even when flying at an al*titude of 25,000 feet*, where the outside air *is thin High altitude air conditioning* is ne complished by blowers or *superchargers which force more and more air into* the cabin as the plane goes higher, to make up for the loss in oxygen supply as the air gets thinner at high altitudes

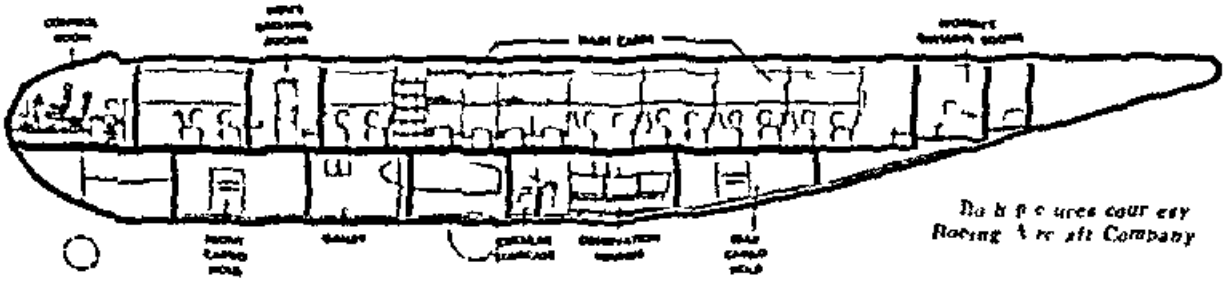
Interiors of the planes will be attractively decorated Seats will be the most comforta*ble that designers can devise with easy rid*ing cushioning The Stratocruiser will have an observation lounge in the lower deck be*low the main passenger deck where the air* travelers can go for diversion to sit and read, or talk with fellow passengers or look out the windows just as in the club car or *observation lounge of a modern streamlined* railway train

With all of these improvements the cost of flying in these great new transports will *still be considerably lower than the cost of*

with vegetables and fruits flowers newspa*pers and magazines mail personal packages* and so on

It is expected that there will be a steady growth in the use of air transportation n t only in our own country but throughout the *world as well Such transportation will mean* a great deal to backward countries which d not have the fine highways and railways that we have had for years The ease f getting around the world by air sh uld mean also that there will be better understanding and closer peaceful relations *between the peoples of various countries who have been strangers* to each other in the past because of the dis tance between them

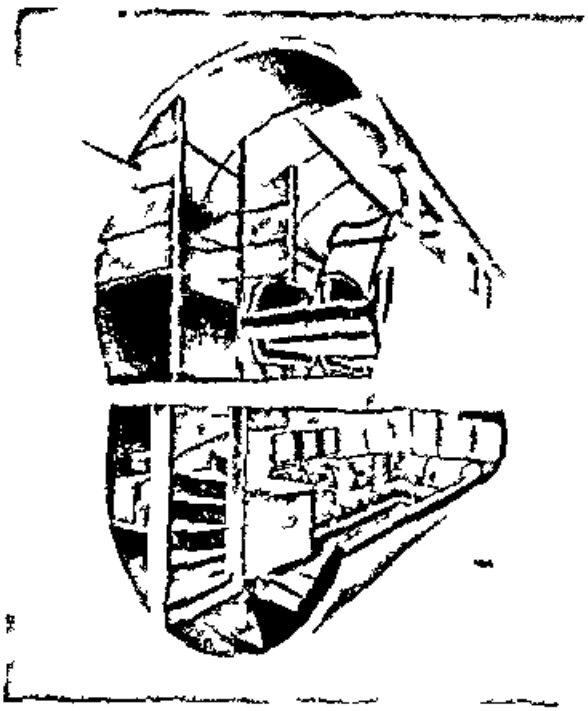
Looking still further into the future engi neers are thinking of new and unconven tional types of aircraft driven possibly not by propellers but by jet *propulsion or by other new methods* But these await further engineering development before they are put into use in passenger transportation That day however, is not as far off as one would have thought a few years ago



Boeing Aircraft Company

A cutaway view showing the cabin *arrangement of the* Boeing Stratocruiser—first of the large airplanes of the future to be built

The Stratocruiser's upper deck is used for day passenger seats while the lower rear cabin is a combination ob*servation* dining room and lounge

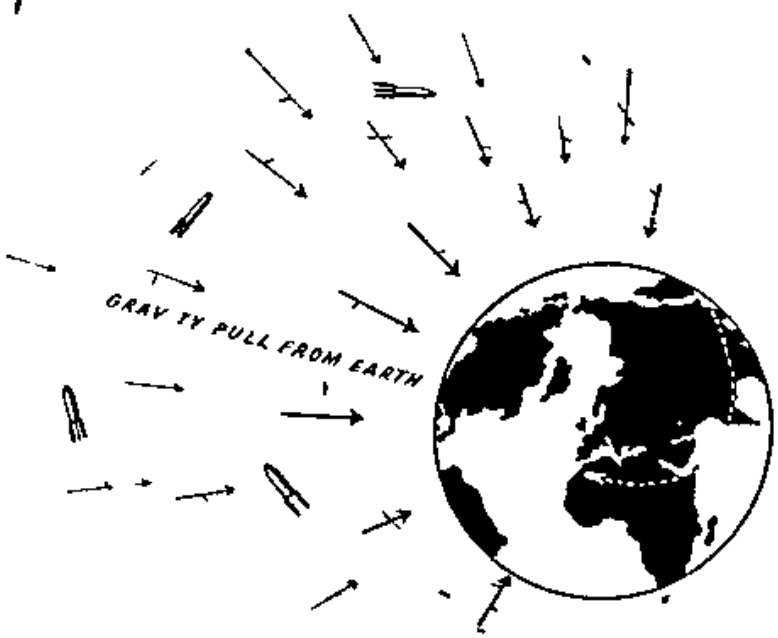


traveling in pre war and wartime planes *This* is because the designers have *found many ways to make the new airplanes more* efficient They will carry greater loads and they will go faster and farther for every dol lar spent in operating costs Greater stream*lining better wings that will carry a heavier* load and many other advancements help to make possible this lower operating cost

Not only will the cost of a ticket for an *airplane trip be within the reach of most people* but the cost of *sending express cargo* by air will also be gradually brought down Large cargo compartments will be provided in the passenger planes other airplanes will carry full loads of cargo Many types of *goods will doubtless be shipped by air, espe*cially where speed of delivery is desired, as

BOOKS *about science for young people*

By **May Lamberton Becker**
Reader's Guide in Books
New York Herald Tribune



Drawing by James Macdonald from ROCKETS AND JETS by Herbert S Zim published by Harcourt Brace and Company Inc.

IT would be more amusing than accurate to say that the years books for young people have been actually keeping up with science For in the last few years—especially the one just behind us—science has made leaps so tremendous that it has gone clean over the heads of amateurs of any age and left them gazing and gasping at achievements they scarcely understand save in their effect on the world today and their possible effect on tomorrow The man in the street does not possess the secret of the atomic bomb and the boy will not find it solved in his school room

But while that blind and deadly weapon the robot bomb of the Germans was still devastating London a book for older boys appeared that gave them a history of the use of various rockets and a description of modern types used in battle today with a preview of some that may be used in the future This is ROCKETS AND JETS by Herbert Spencer Zim (Harcourt Brace and Company) It tells about high altitude rockets and the problems involved in possible future travel between the earth and other planets It describes the German robot and though the book appeared in advance of Hiroshima it tells something about the possibilities opened by atomic energy

This is scientific writing for young people that really meets their needs We all know that if a young person is strongly interested in a subject he will read any book about it even when written for readers much older than he Besides on some subjects—notably invention and applied science—the probability is that a boy of fourteen will have kept up to the times in his reading about them rather better than his father has In this sensible manner several books by Mr Zim coming out a little earlier have made one

audience out of young and more mature readers PARACHUTES SUBMARINES and AIR NAVIGATION are others In MAN IN THE AIR this author explains the effects of flying on the human body All these (Harcourt Brace and Company) have many photographs and drawings

Invention and applied science have always been well represented in our books for young *folks, and those for the year have been un*commonly interesting HOW THE AUTOMOBILE LEARNED TO RUN, by M *Ilin* with lively drawings by Herbert Kruckman (International Publishers) is an original sound and amusingly written history of the development of the automobile MAKING THE MOVIES by Jeanne Bendick (McGraw Hill Book Company) explains with many little colored pictures what goes on behind the scenes in picture making John J Floherty has achieved a special fluency in telling fact stories by a combination of plain text and beautiful photographs His latest is FLOWING GOLD THE ROMANCE OF OIL (*J B Lippin*cott Company) His BEHIND THE MICRO*PHONE (J B Lippincott Company) shows* what goes on before and during a broadcast *at one of the big broadcasting stations*

CLIMBING OUR FAMILY TREE by Alex Novikoff *pictures by John English (Interna*tional Publishers) tells twelve year-olds about the biological development of man MAN'S WAY from caveman to skyscraper by Ralph and Adeline Linton (Harper and Brothers) traces his development from cave dwellings onward for the same age-range

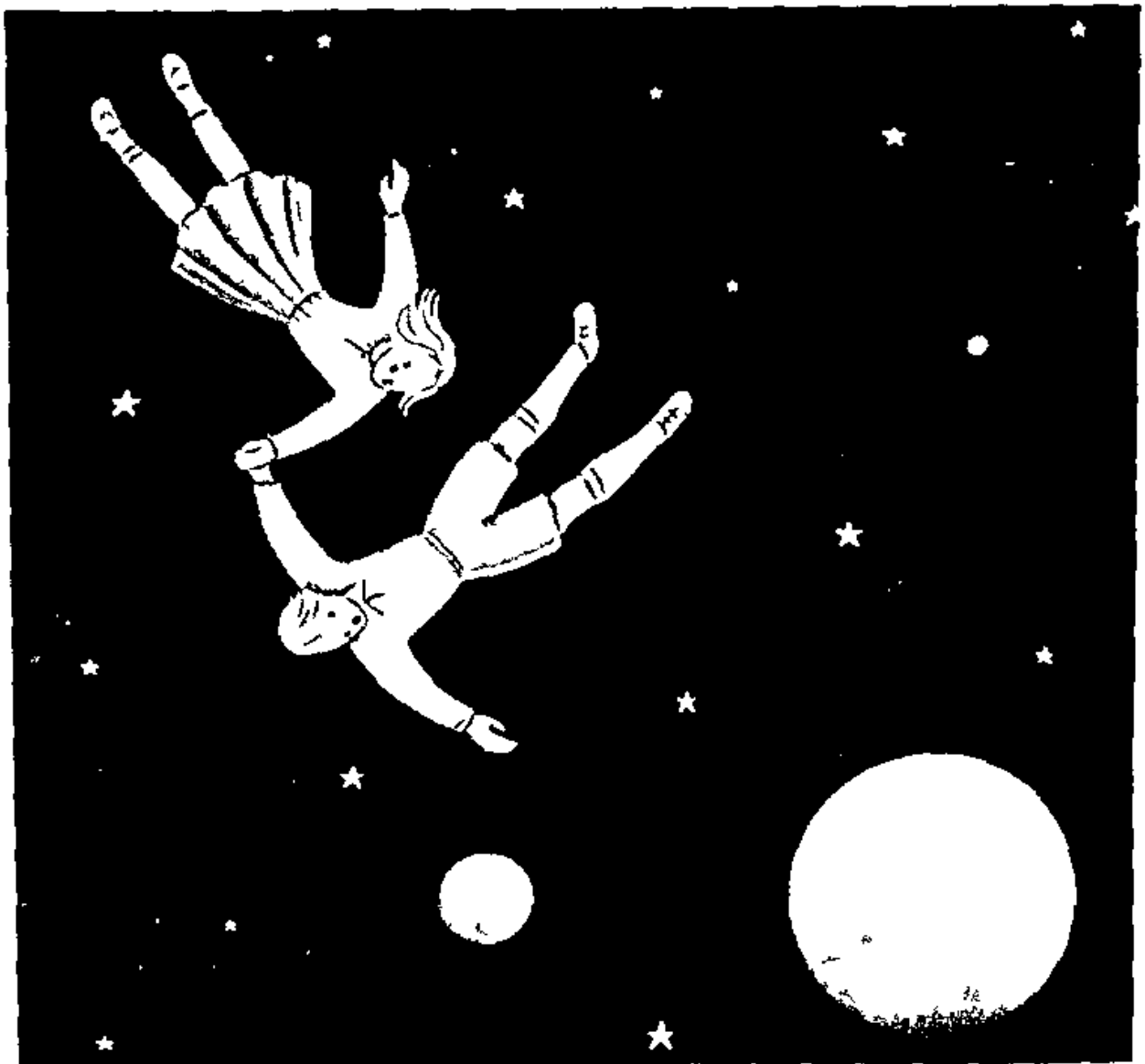


Illustration by Richard Floethe from PICTURE BOOK OF ASTRONOMY by Jerome S Meyer pub by Lothrop Lee and Shepard Co

for younger children is a PICTURE BOOK OF ASTRONOMY by Jerome Sydney Meyer (Lothrop Lee and Shepard Company) with Richard Floethe's dramatic illustrations AN OPEN DOOR TO CHEMISTRY by John L Horning and George C McGinness pictures by Helen Armstrong (D Appleton Century Company) gives ten year-olds an introduction with experiments guaranteed safe

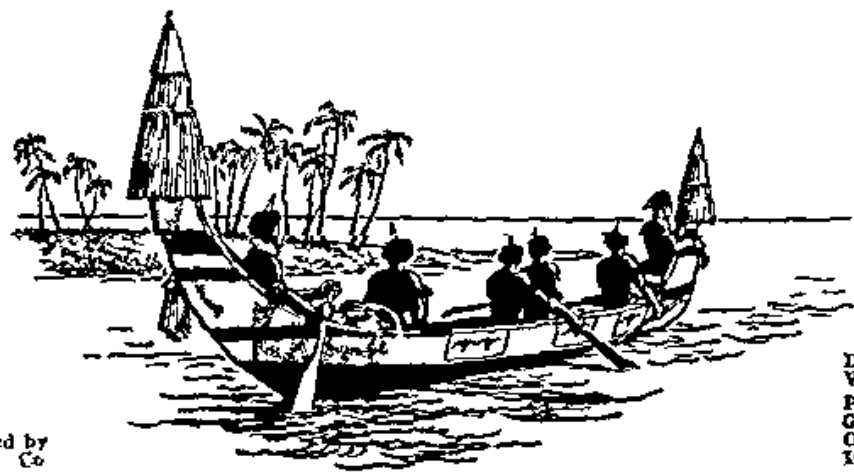
OCEANS IN THE SKY by Vera Edelstadt with pictures by Louis Bunin (Alfred A Knopf) presents to ten year-olds the ancient tremendous story of water BURIED TREASURE by Marion B Cothren (Coward McCann) tells us about the geological background of coal and even more about its human side in mining and through the part coal plays in modern life THE STORY OF WAR WEAPONS by Marshall McClintock (J B Lippincott Company) is for the teens a brief history of mankind in terms of military defense from the primitive man's club to bazookas and booby traps HOW PLANES ARE MADE is in a valuable series by the Aviation Research Associates (Harper and Brothers) There are two new additions to a good series on the great industries of America Josephine Perry's THE ELECTRICAL INDUSTRY and THE GLASS INDUSTRY (Longmans Green and Company)

Often as the mysteries and marvels of the Gulf Stream have moved young students of geography there has not been until now a book for them entirely devoted to this fascinating subject THE GULF STREAM by Ruth Brindze has lovely pictures in tints of blue by Helene Carter (The Vanguard Press) This won the prize for the best book for children under twelve in the Spring Festival of the New York HERALD TRIBUNE

Geography from the air a natural new way of presenting the world to prospective travelers is the subject of SKY HIGHWAYS by Trevor Lloyd (Houghton Mifflin Company) which has drawings by Armstrong Sperry that make a world-circling plane trip seem something in which one is personally involved Vernon Quinn's PICTURE MAP GEOGRAPHY OF THE PACIFIC ISLANDS (J B Lippincott Company) tells about the places where so many of our boys have been making history and shows what these regions are like in years less strenuous THE LAND WE LIVE ON by Carol Lane Fenton and Mildred Adams Fenton (Doubleday Doran and Company) gives in large photographs and brief well pointed text a clear idea of the many kinds of soil and landscape we have here in the United States and makes out a striking case for conservation

Natural history for little children already well represented in our juvenile literature has this year been resting on its laurels But there are two excellent new books FARM ANIMALS by Dorothy and Nils Hogner (Oxford University Press) a large carefully illustrated companion volume to their ANIMAL BOOK that takes in all the domestic creatures from guinea pigs to horses and a jolly little volume by Wilfred S Bronson TURTLES (Harcourt Brace and Company) which conveys information on this favorite pet by a combination of large-print text and many striking drawings

As will be seen the year's books for young folks do not attempt to keep them abreast of the latest developments in science They do however make a well reasoned effort to supply all along the line the information a child needs to feed an already formed interest in some department of science and to stimulate the forming of such an interest by making facts fascinating without dressing them out with fiction



Drawing from Vernon Quinn's PICTURE MAP GEOGRAPHY OF THE PACIFIC ISLANDS

Published by J B Lippincott Co



Boy Scouts of America

By **Lorne W Barclay**

HUNDREDS of thousands of boys joined the Boy Scouts in 1945 to share in Scout work as well as in fun and good times The Boy Scouts have programs for three age groups Cub Scouts are from 9 to 11 years Boy Scouts are 12 years old and upward Senior Scouts are 15 years and upward Among the Senior Scouts are Air Scouts Explorer Scouts and Sea Scouts

All three groups helped win the war In the eight war loan drives that have been held since the war began they took an active part in selling some two bill on dollars worth of war bonds and stamps

When 90 per cent of the boys in a Cub Pack or Scout Troop bought war bonds and stamps regularly that Pack or Troop was given a special award by the United States Treasury Department This was the Scouts at War Minute Man Banner

General Eisenhower approved of the work of the Boy Scouts in the Boy Scouts General Eisenhower Waste Paper Campaign held in March and April The goal was 150 000 tons of wastepaper Cub Scouts and Scouts col lected more than 240 000 tons A World War II Shell Container with a citation from Gen eral Eisenhower was presented to each unit that collected a thousand pounds of paper for each boy in the unit

For the third year Boy Scouts took part in the Green Thumb Campaign to raise food crops Cubs and Scouts tended more than 500 000 gardens

Boy Scouts also worked on farms and helped farmers harvest the crops A Green Thumb Certificate of Merit was presented to boys who helped the Food for Freedom program

In the spring of 1945 a campaign was held throughout the United States to collect good used clothing for the suffering people of Eu rope Scouts and Cubs did a fine job in this campaign They collected one tenth of the total of 150,000 000 pounds that were raised throughout the country

Boy Scouts work hard but they don t work all the time In 1945 for instance they went camping more than ever before Hundreds of them went to Philmont Rocky Mountain Scout Ranch the wonderful wilderness camp in New Mexico Cub Scouts had f ne times in day camps and did many interesting things in the r home neighborhoods

Air Scouts had a chance to camp and to study Air Scouting under Army Air Corps leaders in special training held in various parts of the country

On October 20 Scouts and Cubs from the New England states held their Annual Pil grimage to the grave of Theodore Roosevelt About four thousand Scouts from the New England states took part

There are about 1 500 000 boys in the Boy Scouts of America and about 57 000 Packs and Troops There are Scouts in more than 70 different countries

Many Scouts and Cubs abroad suffered terribly during the war For their sakes Boy Scouts of America emphasized world friend ship and brotherhood A World Friendship Fund was begun to help rebuild Scouting abroad The theme for the year was Scouts of the World—Brothers Together

BOY SCOUTS OF CANADA



Canadian Scouts crossing the International Bridge between Canada and the United States to join American Scouts at a weekend camp

By

B H Mortlock

WHEN Lord Baden Powell founded the Boy Scout movement in 1908 he based much of its code on that of the Knights of the Round Table One of the traditions of the knights was that they must do a kind deed every day This is the origin of the idea of the Boy Scout Good Turn During the past year Canada s Boy Scouts have done many good turns for the community and the nation and for other nations as well

In Kelowna British Columbia the local newspaper published an editorial telling about the need for a museum for the town The Second Troop of Boy Scouts took up the challenge They made an old barn into a museum and stocked it with 4 000 exhibits These ranged from a collection of Okanagan Valley butterflies to stuffed birds and reptiles and from Indian relics hundreds of years old to souvenirs of the Second World War

Another typical community good turn was done by the 134th Toronto Wolf Cub Pack These junior Boy Scouts shared in building the new Toronto Sick Children s Hospital The fifty members of the Pack started a wastepaper drive and with the proceeds they bought a $50 Victory Bond They gave this bond to the Hospital Building Fund

There are many kinds of good turns One was the Seeds for Britain campaign Canadian Scouts gave several hundred pounds of garden seeds to their brothers in Great Britain for Scout Victory Gardens Canadian Scouts have taken great interest in fire prevention and in reforestation and have directly sponsored some reforestation schemes The Tenth Toronto Troop which has had a remarkable record of war work raised $1 500 to help put Scouting back on its feet in the island of Jersey

The Cornwell Badge is the highest Scout award in the British Empire for fortitude It has been awarded in Canada less than ten times since it was inaugurated more than twenty years ago During the year the Cornwell Badge was awarded to Bobby Oke of Newton Heights Moncton New Brunswick Bobby was injured in an accident in 1937 and has been confined in a cast almost ever since Although he must lie on his stomach all the time Bobby has maintained a high standing in school work has kept up his scouting and has even helped to train recruits and has made a number of airplane models and tanks

In Saskatchewan for the second year in succession uniformed Boy Scouts had the honor of escorting the Speaker of the Legislature to his chair at the formal opening of the Provincial Parliament

A Boy-Scout group is made up of a Troop a Wolf Cub Pack and a Rover Crew There were 2 090 of these groups in Canada last year and churches were their largest sponsors Scout membership during the year grew to a total of 92 976 an increase of 5 881 over the previous year New tests became official on September 1 for Tenderfoot Second Class and First Class Scouts A new program has been designed and put into effect for Senior Scouts

His Excellency the Earl of Athlone Governor General and Chief Scout for Canada departed during the year Canada joined in welcoming a new British Empire Chief Scout Lord Rowallan who is scheduled to visit Canada in 1946

During 1945 representative Scout leaders of South American countries visited Toronto Ottawa and Montreal They were received by Prime Minister W L Mackenzie King and were entertained by His Excellency the Governor General and Princess Alice

CAMP FIRE GIRLS

By C Frances Loomis

HAVE you ever taken care of a baby rat? Not long ago twenty little girls in a California town had great fun playing nursemaid to two of these lively creatures The girls were members of the Blue Birds which is a junior club of the Camp Fire Girls You have to be seven years old to join the Blue Birds When you are ten you may graduate into the Camp Fire Girls

These California Blue Birds owned two baby white rats each weighing only 20 grams A gram is a very small fraction of an ounce They named the babies Wienie and Superman The girls kept charts of the rats diets and weights Superman was lucky He dined royally on powdered whole milk 100 per cent whole wheat bread and carrots Poor Wienie was given powdered coffee white bread sugar and turnips

At the end of eight weeks Superman had grown into a fine, husky fellow He weighed 138 grams And poor Wienie weighed only 26 grams! This group of Blue Birds will never forget what a difference a balanced diet can make

What we learn through pleasure we never forget is one of the principles of Camp Fire activities In their weekly meetings Blue Birds and Camp Fire Girls choose what they would most like to do with the help of a friendly leader It s no wonder that more than 340 250 girls now belong to the Camp Fire Girls Senior members, fifteen years or older are called Horizon Clubbers They have a special program to satisfy their more grown up interests which include personality and good grooming boy friends careers and community service Every year each Horizon Club works on some special project such as helping with handicraft for children and servicemen in hospitals

Did you ever stop to consider just what responsibilities you should be able to shoulder at your age? A group of Blue Birds in Oklahoma City made up the following list If you are between the ages of seven and ten years old see if you think you can do the following things

1 Clean up quickly
2 Act quietly in public places
3 Make more friends
4 Think twice about interrupting
5 Be able to do an errand
6 Read without skipping words
7 Print without going off the line

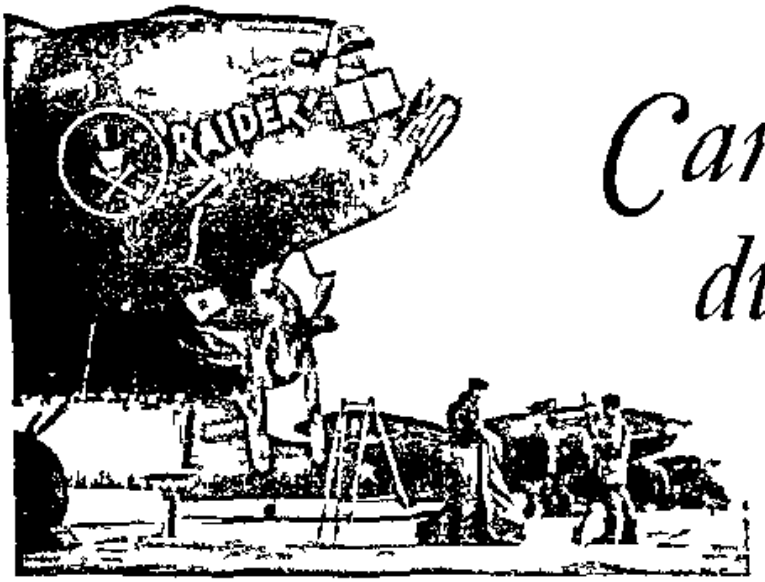
Their leader told these little girls that making up this list was a real experiment in democratic living The Blue Birds soon discovered that they were much more willing to live up to rules that they had helped to make

Every year Camp Fire Girls choose a national project and Hi Neighbor! was the 1945 one As the name suggests this was an adventure in friendship As a grand climax to the project many of the groups staged a Neighborhood Fair

Throughout the nation Camp Fire Girls served their country well as hospital aides farm aides victory gardeners child care aides messengers and as purchasers and salesmen of war bonds While serving their country Camp Fire Girls remembered the young people of Europe and Asia They sent books clothes toys and other necessities to children in China Russia England and the liberated countries of Europe



One of the summer camp activities of the Camp Fire Girls was making Christmas t ees for the Red Cross



Canada during the Year

By Charles Clay

THERE can be no doubt that 1945 was a banner year for Canadians of the World War II generation The year saw Canadian flyers and soldiers triumph in Europe it saw Canadian sailors complete their Atlantic convoy undertakings it saw Canadian workers and farmers fill the largest production schedules ever undertaken by the country and it saw Canadian scientists contribute greatly to mankind s most difficult exploit—the splitting of the atom

The satisfactions joys and sorrows of V E Day and V J Day were experienced by Canadians in full measure at home and on the fighting fronts And with the announcements of victory over Germany and Japan the Canadian Government put into motion its already well laid plans for post war reconstruction and progress

With the close of the war, many figures on Canada s total war effort were reported to the nation During the six years of conflict 1 000 000 men and 43 000 women went into Canadian military uniforms and served on every front In the air crew alone 131 533 graduated from the famous Canadian-operated British Commonwealth Air Training Plan Approximately 7 000 buildings hangars and drill halls were constructed under the plan Most of the Royal Canadian Navy s war work was defensive Canadian warships escorted 25 343 merchant ships carrying 181 643 180 tons of vital cargo from North America to the United Kingdom Many other thousands of ships were escorted on the return trips to North America and during the African campaigns and landings The Canadian Navy lost twenty four ships in engagements with the enemy Thirteen Canadians won the Victoria Cross during the war

With the actual fighting over steps were taken to reduce the country s fighting forces The peak war strength of the Royal Canadian Air Force of 232 500 was cut to 20 000 for the permanent air force after the war In 1939 there were only 4 000 Royal Canadian Air Force personnel Another law cut Canada s permanent active army to 25 000 men supported by a six-division reserve That is five times the size of the Canadian Army of 1939 Parliament also set the post war Canadian Navy at 10 000 men on active service and 18 000 men in the Royal Canadian Navy Reserve There were only 1 700 men in the Navy in 1939

After V J Day war production figures which had remained secret during the fighting became public information Many of these figures were dramatic For example Canadians had produced over $200 000 000 worth of radar and optical instruments of types and designs never before attempted by Canadian workers The first production unit of radar was shipped to the United States Navy in October 1941 two months before the Pearl Harbor disaster More than twenty major types of radar equipment were produced in Canada during the war

Another production secret made public in 1945 was the fact that the most efficient flame throwers of the war were developed largely by Canadians These deadly weapons gave the Allies their final superiority in flame warfare on the Western Front and in the Pacific zones

A dramatic revelation was the news that during the year at least 250 Japanese paper balloons carrying bombs and incendiary can

isters were dropped on western Canada Research experts bomb-disposal squads air force personnel Royal Canadian Mounted Police and provincial police Indian trappers and forest rangers joined as a co-operative force and combed the great hinterlands of the West and North to recover these missiles and render them harmless Fortunately most of the balloons fell during the winter and were buried in the snow Had the loads been dropped in the summer the heavily wooded areas of the Pacific coast could have suffered seriously from fire

THE COST OF WORLD WAR II TO CANADA IN LIVES AND MONEY

In 1945 it was estimated officially that the war cost Canada nearly $17 000 000 000 The Government paid one half of the military and civil expenses by means of taxes It paid for the other half by borrowing from the people of Canada During 1945 alone there were two Victory Loans and bonds totaling just over $3 000 000 000 were purchased by the Canadian public

Besides the financial cost of the war Canada paid in terms of Canadian lives The total casualties up to May 31 1945 were dead 37 964 wounded 53 073 missing 2 366 In proportion to the population of Canada these figures are very high

In terms of civilian goods Canada like the United States actually gained through the war The British people tightened their belts—that is they had less civilian goods than they had before the war But Canadians and Americans let their belts out a little They consumed more than they did before the war

The per capita purchases of civilian goods and services in Britain dropped 15 to 20 per cent from the pre war level but in Canada and the United States they increased 10 to 15 per cent All three countries cut down on motor vehicles—Britain where no gasoline was allotted for ordinary civilian use by 95 per cent and the other two countries by 52 per cent

The general upward trend in Canada and the United States as contrasted with the downward trend in Britain was shown in such items as Food—down 11 per cent in Britain, up 8 per cent in the United States and 6 per cent in Canada. Clothing—down 34 per cent in Britain, up 23 per cent in the United States and 22 per cent in Canada Household goods mainly electrical and metal products were down in all three countries but they were down 82 per cent in Britain as against 32 per cent in the United States and only 28 per cent in Canada

V E Day brought changes in Canadian production schedules Many wartime orders which had restricted the manufacture of peacetime goods were lifted Other orders were simplified However in its efforts to prevent inflation the Government did not suddenly lift all wartime controls Some of the restrictions on production were removed first Man power controls were eased And there was a slow but general return to normal business However price controls were rigidly held on many articles to prevent a sudden and disastrous increase in prices

In order to give the Government continued power to act in a national emergency Parliament passed the National Emergency Powers Act This took the place of the War Measures Act under which the Government had had emergency power during the war years

The year 1945 was an election year in Canada There was a general federal election and there were provincial elections in Ontario Manitoba Nova Scotia and British Columbia

VICTORY FOR THE LIBERAL PARTY KEEPS PRIME MINISTER KING IN OFFICE

The Liberal party which had won the general federal elections of 1935 and 1940 was returned to power in 1945 The Conservatives came second and the Co-operative Commonwealth Federation came third The victory gave Prime Minister William Lyon Mackenzie King the record for length of leadership of a political party He has held office for more years than any other Canadian prime minister

The four provincial elections were interesting There were three main political parties—the Liberal the Conservative and the Co-operative Commonwealth Federation (or the Socialist) The first provincial election of 1945 was in the province of Ontario on June 4 It was won by the Conservatives though the CCF Socialists had a strong hope that they might be the victors That was the first real Socialist setback It was followed by another Socialist defeat on June 11 when the Liberals won the general federal election In October there were provincial elections in Manitoba Nova Scotia and British Columbia Liberal Conservative coalition governments led by Liberals defeated the CCF Socialists in both Manitoba and British Columbia The Liberals in Nova Scotia defeated both Conservatives and CCF Socialists



Canadian Army photo
Smoke screen apparatus used by the Canadian Army

However the experiment of the CCF Socialist Government in Saskatchewan which won the 1944 Saskatchewan election continued to be watched with interest The first legislative session ended on March 30 after sitting for six weeks During that time 120 laws were passed a record in legislation Some of these new laws lowered the voting age from 21 to 18 increased old age pensions increased workmen s compensations for injuries raised the gasoline tax from one cent to eight cents a gallon gave the government power to take over certain industries to be operated by the government and set up a marketing board with wide powers over the handling of natural products Other socialist schemes were also being tried out One was a large farm co-operative organized in central Saskatchewan at a place called Landis

During the year two sessions of Parliament were held The first of these was the sixth and closing session of Canada s Nineteenth Parliament, which had been elected in 1940 It was dissolved in April The Liberal Government had been returned to power by the general federal election in June and the first session of the Twentieth Parliament was called in the autumn These two sessions of Parliament passed many important laws to help Canada recover from the war

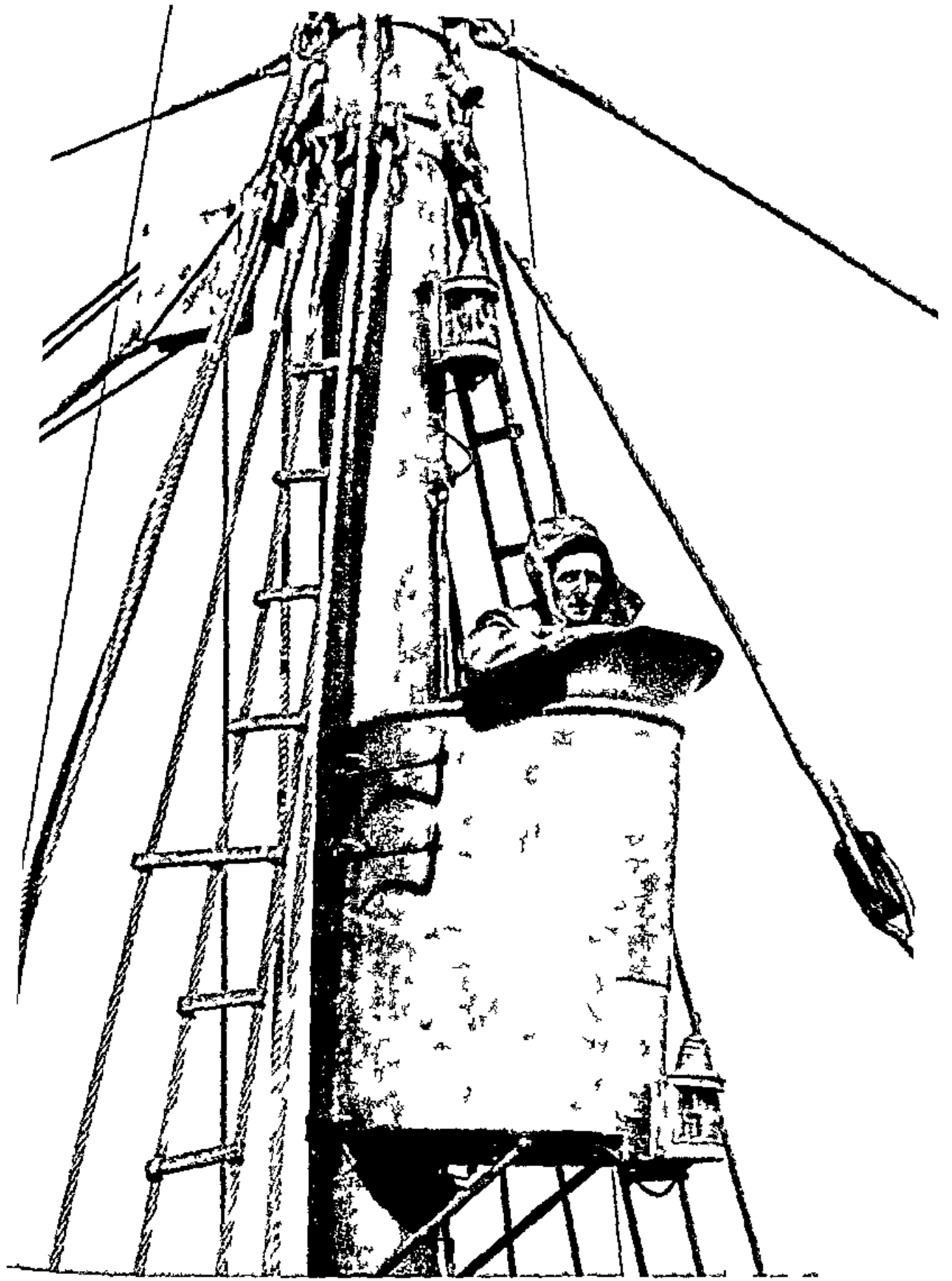
For example the Government established the lowest and the highest price for selling Canadian wheat abroad War destruction and drought had cut the world supply of wheat and it would have been quite possible for Canadian farmers to have asked and received high prices for their wheat on the world market But to ask very high prices would have this effect countries needing wheat would rush into their own wheat production Soon they would not want to buy Canadian wheat at any price By keeping the price reasonable the Canadian Government has assured a market for Canadian wheat over a long term of years, and has enabled countries to use their energy and time for other important things besides growing wheat That policy is directly opposite to charging as high a price as a customer will pay It has proved once again that Canada can lead the world in economic reconstruction practices

Several steps were taken by Parliament during the year to expand Canada s trade partly by a revival of pre-war markets and partly by the promotion of new ones A Canadian Trade Commissioner s office was opened in Portugal the first of its kind in the Iberian Peninsula

Two months before the war ended in Europe the Government announced it would spend $30 000 000 in the development of vocational training facilities and courses in the post war period As part of this re-employment plan the Government set up a nine man committee to help shift men from the armed forces into essential industrial jobs

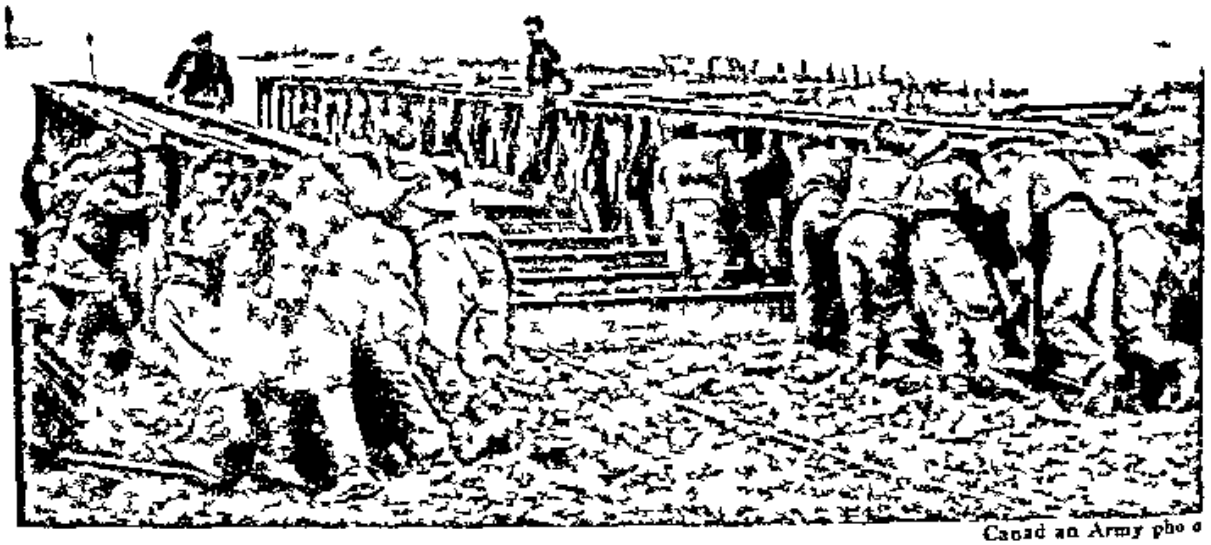
A GOVERNMENT PLAN FOR THE CARE OF CANADIAN CHILDREN IS TRIED OUT

In January Prince Edward Island was chosen for advance registration under the Family Allowances Act in order to provide experience for registration in the larger provinces By July 18 the plan was in operation Family allowance payments for 3 000 000 Canadian children were mailed Minister of Health and Welfare Brooke Claxton said Through family allowances, one-quarter of our nation will receive new economic opportunity for better nutrition, better shelter better clothing more education and recreation Family Allowances are a recognition by the people of Canada and their governments that our children must be properly cared for, and that the soundest way to do this is to spread the cost throughout the entire country '



RCAF ph o

The ows no t of a Canad an sh p wh h p owed he N th A antic be k and forth to I e and ca rying supp ies o Canad an a rm n H gh n these lone y pe h s ookou s b aved the fu l ce of b tter win ry gs es The a ea was a fa or e hunting ground fo Nazi s bmar nes and a onstant wa h had to be kept.



Canad an Army pho o

Slipping in the mud Canadian soldiers build a bridge across the Rhine for the advance into Germany

At the first session of the Twentieth Parliament the Government announced its plan to beautify Canada s capital city Ottawa and at the same time to convert it into a permanent national war memorial Plans for a new Canadian flag and for the recognition of Canadian citizenship were also announced Two conferences were held in Ottawa on the subject of Dominion Provincial relations The first one in August, laid the ground work for new approaches to Canada s internal problems A number of federal government proposals were accepted with a few changes at a second conference in November

A number of discoveries and expansions were made in scientific and industrial fields in 1945 The year also saw the announcement of a number of war discoveries which had been under a security censorship In February the secret of Wing Commander William R Franks ingenious flying suit was made public By using this suit fighter pilots were saved from blackout due to high air speed This gave the United Nations pilots a big advantage over enemy pilots

Another war discovery was a Canadian developed drug named heparin used with a tiny metal tube The drug and the tube together enabled surgeons in the armies of the United Nations to save many arms and legs of wounded veterans When a bullet or shrapnel cut an artery in two the tube was used to join the break and the heparin drug prevented blood from clotting Hundreds of amputations were prevented by this Canadian discovery

Using raw materials and steam from the government owned synthetic rubber plant in Sarnia a new chemical industry turned out styrene plastic a raw material never before produced in Canada Combs trays lenses and other articles for home and industrial use are made from styrene It is more transparent than glass more buoyant than kapok and a better electric insulator than rubber

It was announced in February that phalium a soft white metallic material used in



Cana an Army photo

The first Canadians to enter defeated Tokyo—Colonel R S Malone and Major C C. McDougall.

alloys was being produced for the first time in Canada at Flin Flon Manitoba

Much progress was made toward rural electrification in the three prairie provinces Both Manitoba and Saskatchewan completed their plans for the electrification of most of their rural homes Alberta began an experiment designed to put electricity into 60,000 of that province s 100 000 farms

As a result of Canadian scientific investi gation in the field of transpolar navigation aerial navigators in the polar regions can find their bearings in winter or summer keep track of changing compass readings and obtain a reliable weather forecast in a fraction of the time formerly required

There were several important developments in transportation By an Act of Parliament the Trans Canada Air Lines was given power to carry passengers across the Atlantic across the Pacific and along the southern skyways to the Latin American countries Canada became a member of the Commonwealth Air Transport Council which *was set up to serve as a medium for the* exchange of information on civil air transport among Commonwealth countries The first jet propelled airplane flight ever made in Canada took place on September 13 when the Gloster Meteor flew from Montreal to Ottawa in less than thirteen minutes This trip took two hours and ten minutes by the fastest train of that year

The Canadian Pacific Railway converting to peacetime travel was the first Canadian company to stress comfort and privacy in rail travel by building sleeping cars having these appealing characteristics Since more than 20 per cent of Canadians earn their living directly and indirectly by travel that development helped to produce many new post war jobs

Canada entered World War II with forty ocean going merchant vessels and ended the war with more than 250 of them Some of *these were sold but enough were kept to* make Canada one of the maritime nations of the world

The government of Manitoba established a fund so that a person injured in an automobile accident through the negligence of another but unable to collect money to pay hospital bills could get help Motor car owners in the province were assessed one dollar per year to build up the fund The new legislation was the first of its kind in North America covering traffic injuries

The most notable communications development was in radio The Canadian Broadcasting Corporation opened its new short wave *nineteen meter band transmitter* at Sackville New Brunswick Reports from listeners on the continent of Europe showed it was the strongest broadcaster from the New World *This was due to the antenna system* as well as to the location of the station Radio waves from Sackville travel in the most direct route to Europe and are free from the interference of the North Magnetic *Pole*

As in former years Canada was in the forefront of international co operation She played host to two important international



Twenty United Nations are represented at a meeting of the International Civil Aviation Organization in Montreal.

meetings One was the first session of the In terim Council of the Provisional Interna tional Civil Aviation Committee which was held in Montreal during August

In October Quebec City was the birth place of the Food and Agricultural Organiza tion of the United Nations The meeting was under the preliminary chairmanship of a Ca nadian Michael L Pearson Canadian Am bassador to the United States The event was widely heralded as the beginning of a new world era when modern science and man s ingenuity would be combined to assure enough food for every human being

Canada sent representatives to the San Francisco Conference which drew up the charter of the United Nations Organization and her representatives with their staff of ex perts received praise for their contribution to the discussions and agreements The House of Commons approved the charter on October 19 the Senate on October 25 and the ratification was deposited in Washington on November 9

The Government announced its intention to participate in the international monetary fund and the international bank for recon struction which had been set up by the Bret ton Woods Agreements These arrangements were intended to help the nations recover their peacetime production capacities

In March Prime Minister Mackenzie King went to Washington to confer with the late President Roosevelt Soon thereafter an announcement was made that Canada and the United States had agreed to co-operate in peacetime as they had done during the war It was announced that they had agreed jointly to seek a reduction of barriers to world trade President Roosevelt said that both Canada and the United States recog nized a common interest in working toward the removal of discriminations and the re duction of barriers to the exchange of goods between all countries

Prime Minister Mackenzie King spent the month of October in Great Britain to dis- cuss with British Prime Minister Clement Attlee matters of interest to the two coun tries On his way back from the United Kingdom Prime Minister King visited Har ry Truman President of the United States In November King Attlee and Truman met in Washington D C and discussed the fu ture of the atomic bomb

Other forms of co-operation between Can ada and the United States included a joint Canada United States Committee on Edu cation It was set up by the American Coun cil on Education and several Canadian edu cational organizations and began a survey of textbooks and other teaching materials in the field of United States Canadian rela tions Conservation of fish resources of the Great Lakes was discussed by United States and Canadian officials and they recom mended that their two countries enter into a treaty for this purpose

Canada announced in January that she would accept the interim agreement and also the permanent convention on international civil aviation which had been drawn up at Chicago the previous December Montreal became the home of the provisional organiza tion until its permanent home could be estab lished This meant that Canada was among the first nations to accept the two freedoms of the air—the privilege of foreign airplanes to fly across Canada without landing and the privilege to land for non traffic purposes

Canadian delegates attended the Inter American Conference on Radio Communica tions in Rio de Janeiro in September And Canada established its first legation in Cuba

These were the chief ways in which Can ada in 1945 accepted her responsibility as a nation in the world community of nations And by these activities she became widely acclaimed as the leader of the small and



Boat-building on Nevis one of the Leeward Islands.

Caribbean Islands

By Coert duBois

Member of the Anglo American Caribbean Commission 1942-1945

THE United Nations Charter was adopted in 1945 in the city of San Francisco, a long way away from the waters of the Caribbean Sea. Nevertheless to the people who live on the Caribbean islands the signing of that charter was of the very greatest importance. They were especially interested in the agreement of Great Britain, Holland, France and the United States to three of the chapters in that charter—Chapters XI, XII and XIII. Let us see what these chapters say.

Chapter XI is a declaration to the effect that the mother-countries recognize the principle that the interests of the people of their colonies come first. Great Britain, Holland, France and the United States accept as a sacred trust the duty to promote the political, economic, social and educational advancement of these people. They agree to assist them in becoming self governing. What is most significant, the mother-countries agree to give an account of their stewardship to the Secretary General of the United Nations Organization.

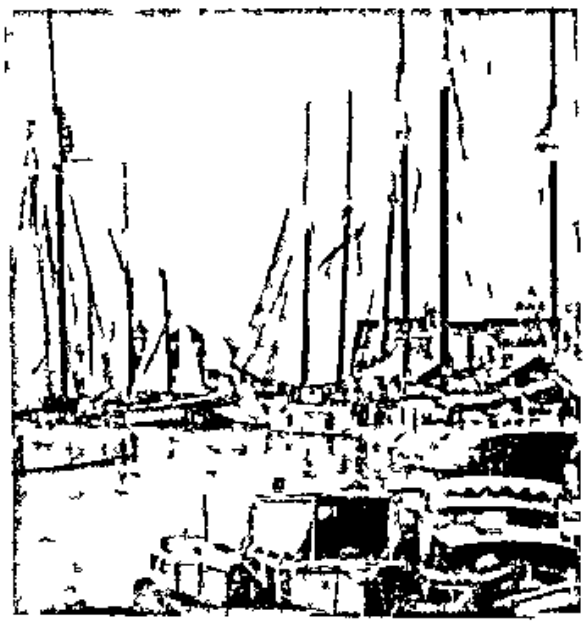
Chapter XII sets up a system of international trusteeship. The purpose of this system is to carry out the principles that you have just been reading about. But the dependent territories will have a voice in the matter of their trusteeship. Each application of the system to any territory must be the subject of a specific agreement between the administering government and the dependency.

Chapter XIII sets up a Trustee Council under the General Assembly of the United Nations Organization to supervise the working of the international trusteeship system.

This agreement means in effect that Great Britain, Holland, France and the United States have obligated themselves to work toward self government for the Windward and Leeward islands, Barbados and Jamaica, Guadeloupe and Martinique, Curaçao and St. Eustatius, Puerto Rico and the Virgin Islands.

The goal of working toward self-government is a high one, but we must not expect too much progress all at once. In most instances progress will necessarily be slow. The vast majority of the people in many of the islands are descendants of slaves who were brought over from Africa. There are many among them who can not read or write. Education is one thing that people must have in order to vote intelligently, and intelligent voting is the foundation of successful self government. You will remember that among the sacred trusts agreed upon in Chapter XI is educational advancement. It will be interesting to follow the progress made by the colonial governments in carrying out their new obligations under the United Nations Charter.

When the Caribbean islands organized for war, they found that they had to work much more closely together than they ever had before. All of them had trouble in obtaining food and other essential supplies, and they had to get together to work out their transportation problems. One way in which they worked together was to organize the West Indies Schooner Pool. This was a co-operative enterprise. The owners of nearly a hundred schooners voluntarily submitted to the



Part of the fleet of the West Indies Schooner Pool One can recognize schooners by their two masts

orders of a Pool Authority in Bridgetown Barbados The schooners ranged from 60 to 200 tons burden, and carried cargoes to points where they were urgently needed, at freight rates fixed by the Pool The Schooner Pool was an emergency wartime creation and the time came when it was not urgently needed It had done a splendid job and it was giving employment to about 3 000 people ashore and afloat It was still handling most of the inter island carrying trade To give up the Pool and to go back to the old cutthroat hit-or miss methods seemed a pity So a peacetime organization has been worked out, known as the British West Indian Schooner Owners Association In its early stages this association will be assisted by certain funds earned by the old Schooner Pool, and these brave little ships will continue to spread their sails to the trade winds

Other peacetime problems are facing the islands Thousands of laborers were sent from the islands to the United States at various times in the last two years to meet the shortage of farm workers These people were distributed from Florida to Maine and from New Jersey to the Rocky Mountains They were a great help in increasing the food supply. They got in the wheat and other harvests Some 40,000 of them entered the United States under agreements made with their respective governments which provided that they should be returned to their home islands at the end of the emergency This was generally considered to be the latter part of 1945 Back home again in the islands, it can hardly be expected that there will be enough jobs for all of these laborers, as well as for all of the soldiers returned from the many theaters of war

HURRICANES HAVE WRECKED HAVOC WITH COCONUT GROVES

The hurricanes of the last two years did an enormous amount of damage throughout the islands, particularly to the coconut groves Many groves were wiped out entirely Jamaica's north coast, which was one long grove, is a pitiful sight Coconuts used to be a profitable export crop but now there are hardly enough trees left standing to supply the demand of the local factories for copra, the dried coconut meat which is used to make cooking oil and soap Bananas, too, were hard hit, not only by the hurricanes but by leaf spot disease which renders the fruit unfit for export and finally kills the tree

The greatest employer of labor in the islands has been the cane-sugar industry, particularly in the harvesting of the sugar-cane The cane was planted on large estates and harvested by hand by large numbers of cane-cutters It was ground and made into raw sugar molasses and rum in local mills and distilleries These products were sold abroad, largely in the mother-countries

Of course the people of the islands had to have something besides sugar to eat, but they grew very little of their own food A large part of what they ate was shipped in from outside, especially rice, salt fish and meat This way of earning a living and of getting enough to eat is called a sugar economy The war upset this economy Many ships were used to supply the armed forces of the Allies Other ships were sunk by enemy submarines Since these ships could no longer bring in supplies, the food shortage grew serious

Now the question is, what is going to happen when shipping is again available? Are the islands going to go back to their old sugar economy?

NEW PROBLEMS FOR THE ISLANDS SUGAR INDUSTRY

There are certain indications that the sugar situation will be more complicated in the future than it was in the old days In two years or less the Philippines and the Dutch East Indies will be back in full production of sugar, and the beet sugar industry of Europe will also be back on its feet Probably the world will see the end of a sugar shortage by 1947 And then what? If too much sugar is produced Caribbean sugar will not bring a

good price This will mean suffering poverty and unemployment for thousands of families in the islands of the Caribbean Too much sugar is what there will be unless there is some system of international control Here is a job for the Economic and Social Council of the United Nations Organization and it will be interesting to see how they handle it

FISHERIES CAN BE MADE TO YIELD A BETTER INCOME

On the brighter side of the ledger there are two industries which through research study and organization, may help the economy of the islands very much These are fisheries and tourist travel A great deal of research has been done on fisheries in the last two years Technical experts have surveyed the marine food resources and fishing methods of Jamaica British Honduras and the Bahamas In reports to the local governments these experts have made recommendations for improved techniques in fishing and in handling the catch A boat was loaned by the United States Navy and fitted out with up to-date gear including otter trawls and purse seines An expert from the United States Fish and Wild Life Service and a British fishery expert spent several months aboard this boat in the Gulf of Paria and off the British Guiana coast and off the island of Tobago, studying marine life and devising improved methods of fishing for the natives to use

Sharks were the subject of a Caribbean wide study A pamphlet in simple language was published by the Anglo American Caribbean Commission telling the island boys what gear to use to catch the sharks and how to prepare the skins liver oil fins teeth and meat for market Several thousand of these free pamphlets have been distributed through local governments and social welfare organizations In 1945 the pamphlet was being translated into Spanish for use in Puerto Rico It is hoped that it will help small fishing communities to earn some money Since sharks are a source of vitamins the study may result in increasing the vitamin supply

The eastern Bahama study covered the waters of the islands from Long Island to Muchoir Passage As a result a dried salt fish industry was started in a small way and has already found a market in the towns on the north coast of Haiti Studies are now being made of the Leeward Islands and the Saba Bank The latter is a large nine-fathom bank a few miles to the westward of the Dutch island of Saba Until this present study its fishery resources had been totally unexplored

Tourist travel has also been the subject of a Caribbean wide study An elaborate report was published by the Anglo American Caribbean Commission in June 1945 This described the principal sites which are or might be developed as tourist attractions in all of the British Dutch French and United States islands and in Cuba Haiti and the Dominican Republic The report presents a regional plan of development Its object is to build up a tourist industry valued at $60 000 000 a year A conference of all agencies interested in travel in the area was held late in 1945

In short the most encouraging feature of the year in the Caribbean is the growing tendency of the people of each island to see beyond their own little spot of land Both the peoples and governments of each island are beginning to think a great deal more about all of the other islands They are getting together more and more to study and work out their common problems In 1945 a second West Indian Conference was planned to be held in the immediate future probably in the United States Virgin Islands to be attended by representatives of all the island peoples Every such meeting helps the scattered islands to understand each other and makes it easier for them to work together to solve their common problems



Courtesy Cuban National Tourist Commission
In Cuba odd two-wheeled carts like this one carry the cut sugar-cane from field to mill.

CENTRAL AMERICA

THE five independent countries of Central America—Costa Rica El Salvador Guatemala Honduras and Nicaragua—went to war against the Axis in December 1941 after the Japanese attack on Pearl Harbor Since that time they have been co-operating closely with the United States and the other countries of the Western Hemisphere They took part in the Inter American Conference on the Problems of War and Peace held in Mexico City (February 21 March 8 1945) and they signed the important Act of Chapultepec drawn up by the conference (See the article on Mexico in this Annual)

As members of the United Nations the Central American countries sent delegates to the United Nations Conference for International Organization which opened at San Francisco on April 25 1945 They all signed the United Nations Organization charter about which we tell you in the article on the United Nations and World Peace

There were several important political developments in Central America in 1945 El Salvador held a presidential election in January This small country had seen much violence in 1944 A general strike had been called in May of that year as a protest against the administration of President Maximiliano Hernandez Martinez who had been in power since 1932 Hernandez Martinez had been forced to resign a provisional (temporary) government had been set up with General Andres Ignacio Menéndez as president Menendez had been forced to give way in his turn in October to Colonel Osmin Aguirre Salinas

The liberal opponents of Aguirre Salinas denounced his government as "dictatorial and fascist" Some of them established a government in-exile in Guatemala Others remained in El Salvador in order to help elect a more satisfactory president in the national election, which was scheduled for January 14 to 1945 There were five candidates for the presidency, One of them General Salvador Castaneda Castro was backed by the provisional president the others were hostile to his administration

The country was thrown into an uproar shortly before the election when the four candidates opposed to Aguirre Salinas withdrew from the presidential race They claimed that their supporters had been terrorized by the provisional government, and that under the circumstances a fair election was impossible When the election took place, therefore there was only one candidate, General Castaneda Castro Naturally he was elected president

The provisional president, who had backed Castaneda Castro as we have seen, claimed that the election had been perfectly fair He pointed out that the right index finger of each voter had been marked with indelible ink after he had cast his vote so that he would not be able to vote more than once But the liberals who had opposed the provisional government observed that, whether voters cast one or ten ballots apiece the result would have been the same since there was only one candidate They also reminded the people that the president-elect had been minister of the interior in the old government that had been overthrown in 1944 Would the citizens of El Salvador be any better off than before?

However the new government proved to be a pleasant surprise One of the first acts of Castaneda Castro after taking office on March 1 was to declare a general amnesty or pardon, for political offenses He urged political exiles to return home promising that they would not be molested and that they would enjoy all the rights of citizenship

As time went on it became clear that Castañeda Castro was determined to govern in the interest of all A revolt against the government was started in July, but the revolt was crushed

Guatemala had also passed through a period of revolution in 1944 General Jorge Ubico who had been president since 1931 had been forced to resign in July As in El Salvador the first provisional government to be established was overthrown, the government was then turned over to a junta or ruling group of three men In December 1944 a national election took place Dr Juan José Arevalo a well known educator

was elected by a big majority

The month of March 1945 was a notable one in the history of Guatemala It saw the inauguration of President Arevalo It also marked the adoption of a new and progres sive constitution which sought to pre ent one man rule and to make Guatemala a genuine democracy It provided that no president should succeed himself until he had been out of office for at least twelve years To keep the army from meddling in politics the constitution provided that no member of the armed forces was ever to be come a candidate for the presidency It also gave women the vote and set up maximum working hours and minimum wage rates

In March, too there began a vigorous campaign to reduce the number of illiterates (An illiterate is a person who can not read or write a literate is one who can read and write) A law was passed in March providing that each literate Guatemalan between the ages of eighteen and sixty was to teach an illiterate person how to read and write This law was patterned after a Mexican law of August, 1944 It provided penalties for literate Guatemalans who took no part in the campaign against ignorance

There were no important political changes n the other countries of Central America President Tiburcio Carias Andino of Hondu ras and President Anastasio Somoza of Nica ragua have been in office for many years and so far they have successfully resisted all efforts to force them out They offer a good example of what is called *continuismo* in Spanish This word is used in speaking of national leaders who continue in office by having the constitution changed or by hold ing government-controlled elections

As for Costa Rica it has set an example of orderly and democratic government for many years That record was marred some- what in February 1945 when a series of anti government riots took place These out breaks which were led by followers of ex I resident Leon Cortes were put down by the government The general public continued to give its hearty support to I resident Teodoro Picado Michalski

Under this president who was elected in February 1944 the government has been distributing to small farmers land that is not being used Some of the land granted under this program was bought from large planta tion owners some of it was taken from Ger man owners after Costa Rica declared war on Germany The land distribution program has increased the available supply of food crops and so has proved to be a valuable weapon in the fight against steadily increas ing living costs

The project of combining all five Central American countries in a single federal union has often been proposed in the past It was revived in May, 1945 when the presidents of Guatemala and El Salvador met in order to discuss plans for a union between their two



All p ctures courtesy Co-ord nator of Inter American Affa rs

Indian fighting men from the highlands of Guate- mala Every group in this country s army has a different uniform, which shows from what village it came.



Children are taught to read lips and make word sounds in this school for deaf pupils in Honduras

countries In a statement issued after the meeting the two presidents proposed first of all to remove all customs barriers between El Salvador and Guatemala to create a single banking system and to permit free immigration from one country to the other Political union would come later The two countries would be joined in a loose kind of federation in which each nation would keep its sovereignty

The two presidents made it clear that they looked upon the proposed union between El Salvador and Guatemala as only the first step in bringing about a wider union binding together all the countries of Central America An official statement issued after the meeting said it was agreed to invite the heads of state and the people of the Central American republics to join the federation

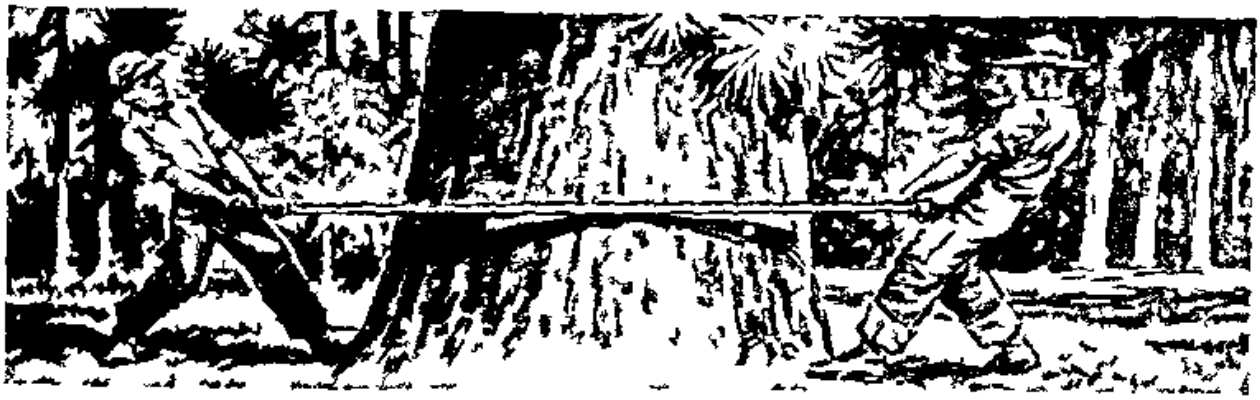
So far the proposed union between El Salvador and Guatemala is still in the discussion stage, nor have the other countries of Central America shown much interest in the matter The prospects for a five state Central American federation are not bright

The region that we call Central America includes not only the five independent countries that we named above but also British Honduras, a colony of the British Empire Guatemala has laid claim to this territory at intervals though it has not pressed the matter so far In 1945 Guatemala again set forth its claim to British Honduras in Article 1 of the new constitution

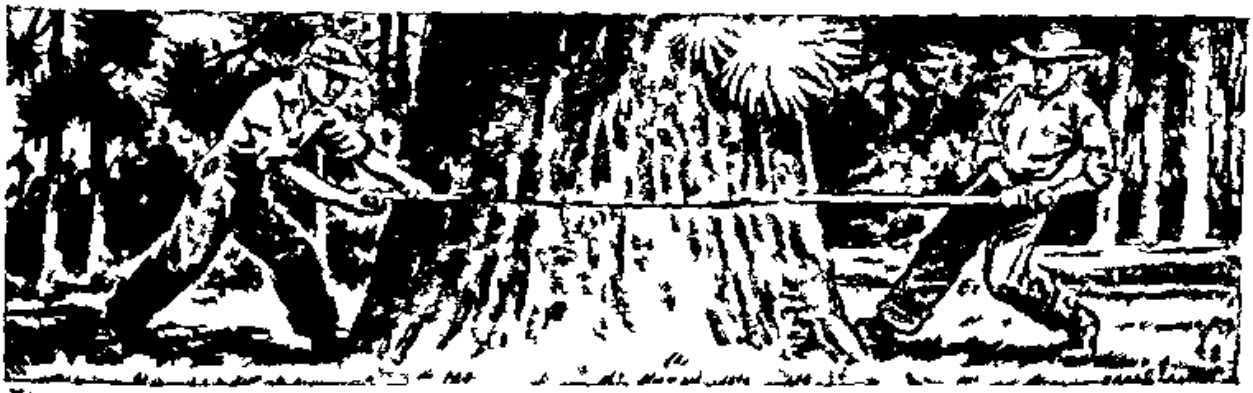
Great Britain points out that the present boundary between Guatemala and British Honduras was fixed by an agreement signed in 1859 and ratified by both countries But Guatemalans observe that in the agreement Great Britain promised to build a highway from the Atlantic coast to Guatemala City the capital of Guatemala Since the British have not built the road in question the 1859 agreement is no longer in force according to Guatemala The dispute has been carried on in a gentlemanly spirit It should provide lively debates between the two countries for some years as no settlement is in sight



Growing plants without soil in El Salvador



CO-OPERATION



No matter how long or how hard they try the men can not cut down the tree by pulling away from each other But when they work together each one pulling in his turn the job is soon done

By William C Lehmann

CO OPERATION *is a live word an ac* tive word It means working togeth er Without co-operation our very homes our schools our churches, society itself could *not exist* Without a good measure of it there could be neither government business nor community life

Our forefathers knew its meaning well in the village communities that made up their life for thousands of years and in the frontier settlements of early America It brought suc cess to the European guild system that bound together merchants master workmen and ordinary craftsmen in their work their leisure and their community life Even today some peoples such as the Zuni Indians of New Mexico and Arizona the Chinese and *in many ways the people of Denmark* make co-operation a foundation stone of daily living

In the teeming life of our modern cities and to a lesser extent also on our farms today, co-operation has apparently come to be overshadowed by individual enterprise and competition But we need only look at the working of any large business concern or of a labor union or of the manufacturers asso ciation of our own home town to realize that even today we can not exist without a con siderable measure of co-operation

Spelled 'team work it expresses a com bination of individual effort fair play and working for a common goal most easily understood by every boy and girl Spelled 'world community it awakens the hope that this world of ours can still be made a place in which all peoples can live and work happily together—this new world in which Lon don and Moscow and Chungking are only a few hours journey from one another by air plane this new world which can be spanned by radio in the fraction of a second

Co-operation as we have seen means working together It stands for the sort of



Greenw ch House
Children co operate to make beautiful music.

effort in which each one of us plays an important part A player on a school baseball or football team may not be a star but he is an important member of the team if he works for its good instead of for his personal glory He is important when he hits a sacrifice bunt and advances a runner from first to second base he is important when he takes out a would be tackler and thus makes possible a touchdown run Just so in the life of the community and in the business of making a living co-operation demands that each one should make the most of himself not for the sake of personal advancement but for the good of the community as a whole The reward of effort in a co-operative spirit is richer because there is more to share and there are more to share it In fact it is the very heart of free enterprise and the democratic way of life

Co-operation may mean any free association between two or more persons or groups or communities working together toward a desired goal in a way they have agreed upon The word has also come to mean a particular kind of business activity in this people organize and own and control the business themselves in a kind of mutual self help

It may help us to understand co-operation better if we remember that there is always in the world about us a natural kind of working together We may not have planned it and we may even be unconscious of it yet without it none of us could live at all

Even in nature there is a web of life that binds individuals and kinds together Swarms flocks and herds instinctively stay together for mutual protection and support Ants protect the aphids that in turn provide them with honeydew Pilot fish and sharks are said by sailors to work together Many animals post lookouts that give alarm signals when danger approaches Among horses on the steppes leading males will take a key fighting position to protect their herd against attacking wolves In the beehive and among some of the ants and wasps there is a division of labor and a co operation so marvelous that it is almost the envy of men

In the life of men too there is much co operation that is scarcely at all the result of conscious planning

PRIMITIVE PEOPLE EARLY LEARNED THAT THEY MUST WORK TOGETHER

The most primitive men of whom we have any knowledge were always banded together in some kind of family or horde and later in a tribe for protection against weather wild beasts human enemies or hunger Among primitive peoples today some will be hunting or fishing while others gather roots or berries or scratch the soil in rude agriculture and still others care fo the children Yet all work together to provide a living to protect their kind to win the favor of their gods And those who break the ranks who refuse to co operate will as a rule be severely punished

Our own forefathers lived in agricultural village communities Here each family had its own strips of land its own cattle and its own harvest but the families worked their fields together and herded their cattle and sheep or goats in common pastures Their woodlots were open freely to all and their strips of land were re allotted from time to time so that all had an equal chance at the favored plots of ground They lived by common rules they all rushed to put out the fire in their neighbors thatched cottage they played and sang and danced together on the village square they worshiped in the common church and when they died they were laid to rest in the ancestral ' God s acre

Today our villages have grown into towns and cities with thousands sometimes even millions of people Our neighbors are so many that we do not even know most of them Instead of an occasional mill or smithy we have a complicated network of factories and market places, of railroads that cross whole continents and ocean liners that tie continents together Air transports slip over Greenland or the North Pole to deliver their cargoes in what was once faraway China

But still there is co-operation between fac tory and field between the cotton grower, the textile mill and the shop on Main Street between the fruit and vegetable grower in California and the man who eats his break fast in New York or Boston or Montreal There is co-operation, too between factory owner and engineer and worker, between manufacturer and banker and our local mer chant

But because most of our neighbors are so far away and our village community has really become a whole world community we have lost something of the old sense of living in a neighborhood Yet co-operation is even more necessary than in the old days Modern business is an exchange of services among neighbors trade is still an exchange of goods among neighbors

Today our whole world is rapidly becom ing one vast neighborhood again Men are awakening anew to the meaning of co opera tion as a conscious, forward looking program and to the needs and opportunities for co operation in every realm both of our national life and of our larger world community

Let us look now at a number of ways in which such co operation has already been tried with marked success and with greater promise for the future

Such co-operation may be seen at its sim ple best among farmers and fruit growers in dry country where fields must be irrigated Crops can not be grown without water Wa ter can not be brought to the fields without tapping the stream up the valley Expensive dams waterways and water gates must be built and ditches must be run through the fields of A B C and D If each tried to tap the stream himself or if A or B up the valley refused to allow water to be run through their waterways to the fields of C and D down the valley or if A took all the water for himself when there was little of it those farther down the valley would lose their crops and farming generally would become impossible By co operation they have learned to make the desert blossom like the rose

In industry we are fast learning that over work or underpay and poor conditions of work make for poor workmanship and there fore loss to the employer as well as poor liv ing for the worker And when workers unite to get equal bargaining power with their em ployer expensive strikes and lockouts and loss of time and great bitterness may threat en ruin to both employer and workers But if the two sides come together and talk it over they often find that half of their wrongs have grown out of their fear one of another and half of the rest are not really wrongs but hardships neither side can do much to avoid while the remainder can best be adjusted by shop committees and other expressions of mutual confidence and co-op eration In fact labor unions and trade asso ciations may in this way themselves become instruments of co-ope ation between worker and employer instead of co-operative weap



Office of the Coord nator of Inter Amer can Affa s

Students of the Americas co-operate to increase the friendly spirit between their lands

ons of industrial warfare wasteful for both

Every city has many agencies to help the underprivileged to provide leisure-time activities (such as the Y or the Scouts camps) and to look after the health of the community If all go their own way there will be costly rivalries and overlapping and waste of the community's money while many important things are left undone In most cities now such agencies have learned to join hands in community chests and councils of social agencies and the whole community benefits This is community co-operation

And so with our churches our schools the work of the Red Cross the work of scientific research of farm and home improvement In all of these we are rapidly learning the lessons of co-operation some with government aid and some without it some merely in the local community and some throughout the whole nation and throughout the world—and the life of our communities is being made the richer by it

OUR BEST HOPE FOR PEACE IS IN CO-OPERATION

World War I and the far more destructive World War II and in between them the great depression have driven home the lesson that between nations also there must be co-operation if we are not all to be destroyed by war Many hopeful beginnings have been made

In 1920 shortly after the close of the first World War there came into being a League of Nations, with headquarters at Geneva Switzerland This was perhaps the most promising experiment in world wide co-operation ever tried Though it was unable to prevent the outbreak of World War II it accomplished many fine things

Under the League there was a Permanent Court of International Justice with fifteen judges representing many nations sitting in court at The Hague in Holland to settle disputes in the meaning of treaties between nations and to interpret international law The United States took part in this court

Affiliated with the League was the International Labor Office with headquarters at Geneva This organization accomplished great things in the creating of better standards of labor the study of immigration the promoting of safety and health work also in opposing child labor and in many other ways It brought labor groups together in peaceful co-operation

On page 316 we tell you of a fresh attempt to bring the people of the earth together in peaceful co-operation, under the heading The United Nations All men of good will hope that this new union may succeed where the League of Nations failed Certainly the world has learned that the old ways of settling disputes between countries will no longer serve mankind but only destroy it *Co-operation is more difficult than dissension* but the time seems to have come when the difficult lesson will have to be learned

As early as the year 1910 there was set up the Carnegie Endowment for International Peace "to hasten the abolition of international war and to promote co-operation between nations through scientific research through the holding of meetings and through education

YOUNG PEOPLE CAN PROMOTE FRIENDSHIP AMONG NATIONS

One of its divisions is the Institute of International Education with headquarters in New York City This institute helps in the interchange of both students and teachers between the United States and other countries the world over By studying and teaching and living together, many people especially young people from many countries begin to understand each other better and then go home and work for international understanding and co-operation

For several years the United States Department of State at Washington D C and the National Educational Association a voluntary organization have joined hands in a number of practical ways with similar agencies in other countries in matters of educational co-operation This is pointing the way to an International Education Office

MAIL GOES TO ALL PARTS OF THE WORLD BECAUSE NATIONS WORK TOGETHER

Except when war interferes tens of billions of pieces of mail are delivered all over the world every year without interference of national boundary lines This is made possible by the co-operation of nearly all countries of the world in the International or Universal Postal Union which has operated successfully since the first international postal convention was agreed upon by twenty one nations at Berne Switzerland, in 1874 In this convention the twenty one countries agreed to consider themselves a single territory for purposes of mail delivery Any differences between nations in the matter of mail service are adjusted through this Postal Union French is the common tongue of the Union



Acme

Hope for an era of peace through co-operation Signing the United Nations Charter at San Francisco

No greater honor can come to anyone in the field of sports than an Olympic championship The Olympic Games are a form of international co operation in sports For over a thousand years such contests were held every four years in ancient Greece and if any of the Greek peoples were at war an armistice was called for the duration of the games In 1896 this idea was revived in Athens and since then there has been world wide participation in these modern Olympic Games They have been held every four years except in 1916 and again in 1940 and 1944 when war interfered One of the chief aims of such sports events is to build understanding and good will among the nations

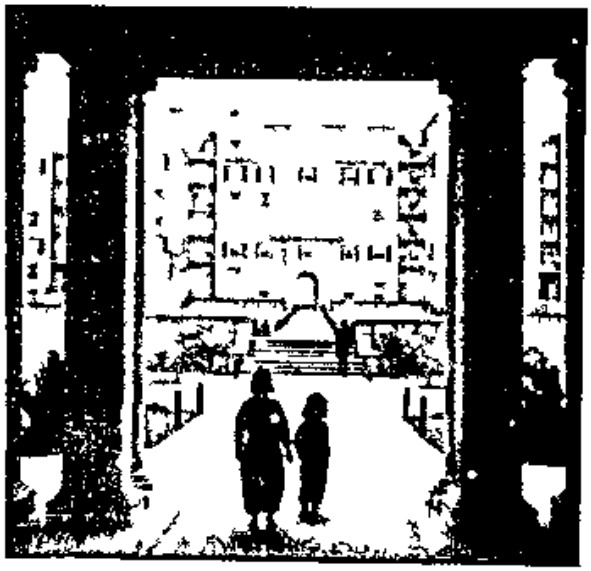
Another splendid example of international co-operation is the Pan American Union with headquarters in Washington D C All of the twenty one republics in the Americas are represented in this union and it is sponsored and supported by these governments themselves Its purpose is to develop closer commercial and intellectual relations and to promote international co-operation With out it these nations probably could never have formed an almost solid front against the Axis powers when the second World War threw nations into turmoil

Let us look now at co-operation in the nar



Pan Ame can Un on

The beautiful patio of the Pan American Building in Washington D C The Union made up of twenty one American republics is a splendid example of how nations can work together to achieve mutual good will.



People living in this fine apartment house own it together Sharing the costs they are able to have a better home at less money than if they bu l s parate hous s

rower sense of co-operatives and the co-operative movement

Consumers co-operatives are the most important form of this movement They are first of all businesses like any other business except that they are organized and owned and controlled by the patrons they are intended mainly to serve They have one aim —to serve consumer needs (Consumer means user When you buy a loaf of bread to eat or a school notebook or a pencil or a new suit you are a consumer)

A group of people usually neighbors or workers in a certain factory or members of a local church will get together and set up a grocery store a gasoline station a general merchandise or farm implement or feed store to serve their own needs They put in some of their savings to start the business and then usually leave some of the store earnings or dividends in the business to buy more shares

They maintain high standards of service to the consumer and sell only for cash and at about the prevailing market price If a buyer knows what the consumers' co-operatives charge for a certain item he has a good idea of the fair price for this item

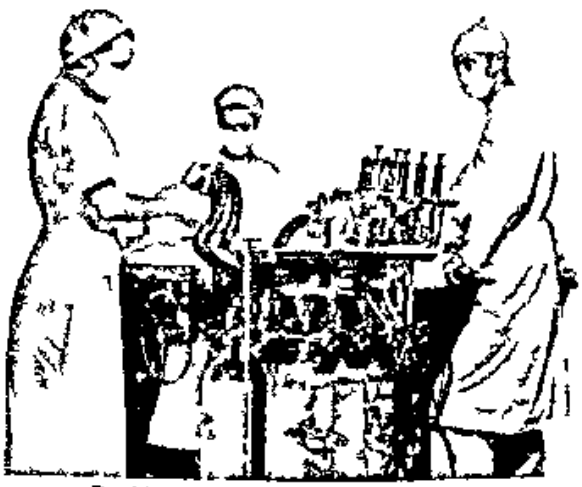
A number of such local co-ops may form a league with other co-ops and organize their own wholesale supply services and other services such as testing for high standards and carrying on educational work Often these wholesale co-operatives when they have grown sufficiently large and strong set up or purchase their own factories mills or bakeries, sometimes even farms or plantations, oil wells and refineries They may operate their own trucking and transportation services and even railway oil tanks and oil pipe lines and ocean liners Later they may also set up their own credit or banking facilities

They thus become not 'producers co-operatives, but production' and distributing as well as retail co-operatives—though always with an eye on service to consumers.

There are of course many other kinds of consumers co-operatives Many of them supply services rather than goods Among the better known and established of these are farmers mutual fire insurance and automobile insurance companies mutual life insurance associations and death benefit and burial societies farmers telephone and rural electrification co-operatives building and loan associations farm loan associations Not all are co-operatives in the strict sense

Among the less known or less tried are co-operative housing projects and apartment houses rooming houses restaurants and similar services group hospital and health insurance associations and co-operative hospitals book stores and library loan services laundries funeral and undertaking services Tennis courts bowling alleys and similar services for fun have sometimes been co-operative ventures

Credit co operatives are a form of consumer service A man with only small savings and little or no life insurance to borrow upon often needs ready cash to pay doctor s bills to meet some pressing family need or even to get a better bargain in an automobile he may need for his work He can



Paul Parker photo Associated Hospital Service

When many people pay a small sum each year into a hospitalization plan those who fall ill can have the best of care in a hospital at little or no extra cost. Such plans for mutual benefit are rapidly spreading

not borrow from banks and sometimes not even from personal finance companies because he can not provide the security good business practice requires of these institutions and he can not or does not want to borrow from friends or neighbors As a rule he can turn only to pawnshops or certain loan offices where interest rates are usually very much higher than they appear to be on the surface

Credit unions are associations of people usually working in a single factory or members of some organization or otherwise personally known to each other who put their savings together and form a loan fund from which members may borrow The funds are well protected the loans are carefully made though risks are sometimes taken where the needs are great There are few if any salaries or other expenses to pay Employers often provide space and clerical workers and other services without cost to such credit unions among their own employees Interest rates rarely amount to more than 1 or 1¼ per cent per month often little more than 6 per cent per year There have been almost no losses or failures recorded Dividends to shareholders are strictly limited Like banks the credit unions operate under government control nearly half of those in the United States under federal charters

In a recent year there were about 4 000 such chartered credit unions in the United States and Canada with an estimated membership of 4 000 000 and an estimated business of about $325 000 000

Finally there are producers co-operatives or producers marketing co-operatives These are usually groups of farmers dairymen cotton-growers fruit growers or such who form associations for the purpose first of all of marketing their products at the best price they can get and without paying middlemen s commissions These associations also provide their members with many other services And just as consumers co operative take on wholesale and production and other activities so producers co-operatives often purchase co-operatively their own feed gasoline farm implements and so on and thus become consumers as well as producers co operatives

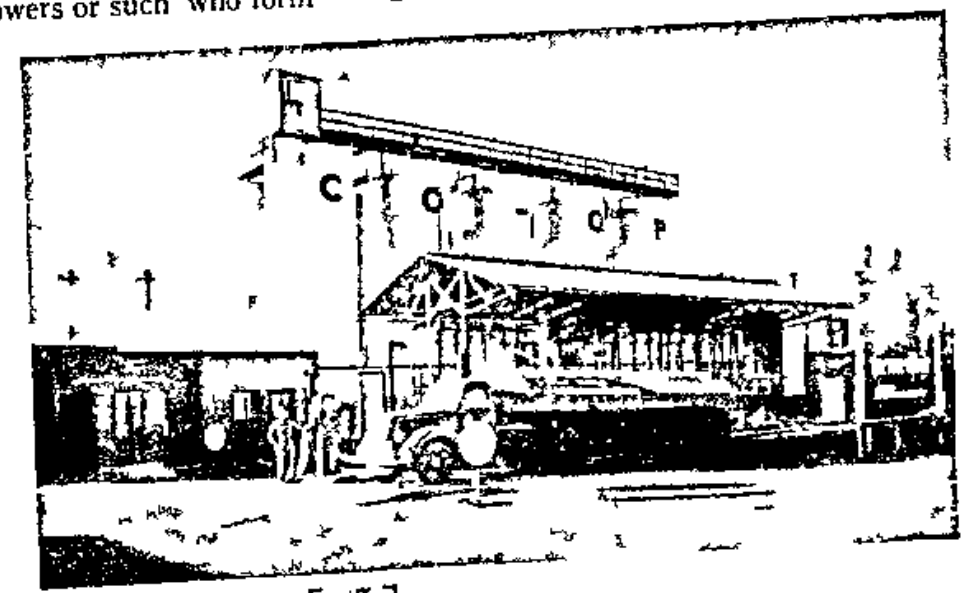
There are a few but only a few production co-operatives that is associations operating farms factories and the like co-operatively for sale on the general market

Then there are of course co operatives banded together in leagues going all the way from local and regional groups to nation wide and international organizations such as the Co operati e League in the United States and the International Co-operative Alliance These help in many ways to promote co operation

They usually operate on the so called Rochdale principles These are open membership democratic control limited interest on capital dividends according to patronage neutrality in religion and politics sale for cash at market price constant education and continuous expansion

The beginnings of modern co-operatives are usually traced to a group of twenty eight weavers in the little village of Rochdale in Lancashire England who formed the Equitable Society of Rochdale Pioneers in 1844 They raised $140 to open the first co-op store to supply their needs for food and clothing at fair prices

From Rochdale the movement spread



Wurts Bros hers Cooperative League

A co-operative oil refinery at McPherson Kansas run for the benefit of the large group of farmers owning it

with many ups and downs and ever enlarg ing organizations all over the British Isles Later co-operatives became popular in the Scandinavian countries and the rest of Eu rope and in other continents as well Today there are 70 800 000 families in 39 countries buying about $20 000 000 000 worth of goods and service a year through co-opera tives In Great Britain over half of all fami lies belong to the co operative movement one eighth of the nation s retail business one seventh of its food d stribution and one eleventh of the wholesale business is done by co-operatives The banking department of the wholesale society is equal to that of the fourth largest bank in England In Den mark 70 per cent of all livestock and farm products are marketed and 70 per cent of all meat packing is done by co operatives In most European countries from one third to two thirds of all families are affected by co operatives

In the United States and Canada the movement was slow to take root Since about 1920 however farm marketing co-opera tives then oil and gasoline and feed purchas ing co-operatives and most recently general consumers co-operatives in town and coun try have increased by leaps and bounds un til in a recent year there v ere in the United States more than 7 700 marketing co-op eratives with an estimated membership of 2 580 000 and an estimated business of $3 180 000 000 and more than 2 700 purchas ers co-operatives with an estimated mem bersh p of 1 270 000 and a business of $600 000 000 Among the service co-operatives there were 850 electricity distributing co operatives with an estimated membership of 1 210 000 and an estimated business of $35 000 000 and 2 000 insurance associations with an estimated membersh p of 10 000 000 and an estimated business of $185 000 000

Nearly all co-operative associations carry on educational programs in the work of the particular organization They explain the principles of co operative business and co operative community living Very many of them also engage in recreational and other fellowship activities

Co-operatives then are a modern expres sion of the co-operative spirit Already as we have shown you this spirit has resulted in great gains to mankind Y et much remains to be done

For example in some communities pupils and teachers and parents—in fact the whole neighborhood—join in making the school a real community center Colleges (like Berea College and Antioch College) and universi ties too have sometimes become centers of community progress Students and faculty and administrators co-operate in planning and managing the affairs of the school col lege (or university) and town work together for the common advantage of all If this spirit of wise co-operation between the edu cational institution and the community were more widespread great benefits would result

As we have pointed out group health and medical insurance programs have already proved successful They point the way to a much wider range of health services and health activities There is also plenty of op portunity for increased co operation in such fields as adult education play and other leisure time activities youth hostels ama teur dramatics and so on

Increased co-operation is also called for as the radio television and the airplane come into ever wider use There would be turmoil if every radio station were to adopt any wave-length it pleased or if air lines were to be set up in regions that already had far more than they needed

We know what great advances have al ready been made in the field of pure science because men and women have worked to-gether without thought of self but for the good of mankind What a wonderful world this will be when all scientists whatever their country may be join harmoniously in the good fight against disease and pain and drudgery and poverty!



Columb a Un ve s ty

Decorating as a Career

By **Helen M Needham**

EVER since the dawn of history when man decorated the stone walls of his cave with drawings and paintings, he has been interested in the appearance of his home Modern man s desire to make his home attractive is as strong as that of his cave man ancestor This desire has given rise to the fascinating business of interior decorating

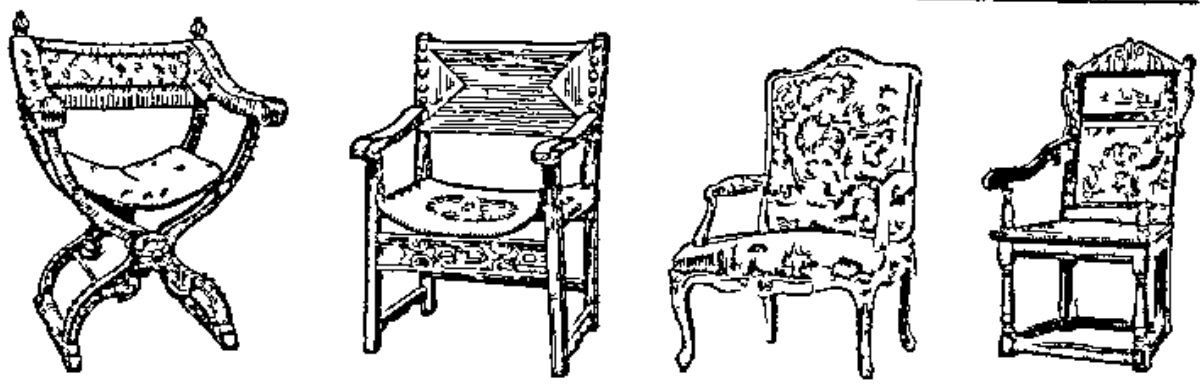
Many decorators today have the delight ful task of making life more pleasant by cre ating pleasant places to live in Interior dec orating is not only fun but profitable as well It is little wonder that thousands of men and women have chosen their life work in this absorbing field It is particularly appealing to women because it puts their special talents to the fullest possible use—their sense of style and beauty their joy in shopping and bringing together lovely and useful things for the home

Decorating is an ever changing profession Man has always liked to change his taste with the shifting trends of the times In his



New York School of Interior Decorat on

Learning to be an interior decorator is fun Using actual materials, students match and harmonize colors and learn to bring out the most pleasing contrasts among the textures of fabrics painted surfaces rugs and woods.



Renaissance chair designs From left to right are an Italian Dante chair a Spanish armchair a French chair of the period of Louis XV and an English chair of Queen Elizabeth's time the Tudor period.

home—as in his politics—he has always seemed to say Off with the old and on with the new This truth about human nature is one of the reasons that so many trends have come and gone in the field of interior decoration

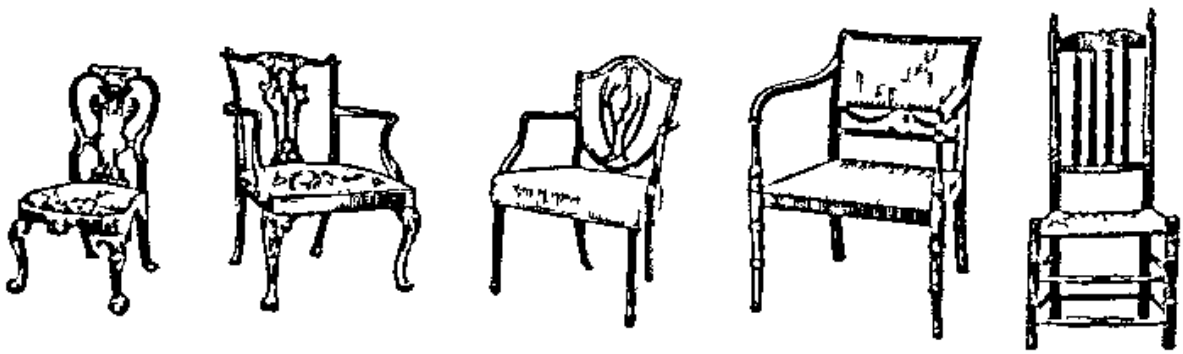
It is possible to learn something about people just by studying their homes If we look in old magazines and books for instance we may see pictures of the crowded rooms that matched the elaborate dress and sentimental viewpoint of men and women in Queen Victoria's day By way of contrast when we study the furniture built by the Shakers we see how its sturdiness and simplicity reflect the sober values of their lives

In museums we may revel in the wonderful variety of furnishings of bygone days We may see with our own eyes the kinds of chairs and benches that people used to sit on long ago the chests in which they stored their treasured linens the beds they slept in and tables of all sizes that they used in many ways As we marvel at the great beauty of woven tapestries we may remember that their original purpose was to hang on the walls of the very wealthy to keep out the drafts, long before there was such a thing as central heating And gallery after gallery of paintings by great artists remind us that people of olden times liked to have beauty grace their homes just as much as the early cave men did Beauty as well as usefulness are the twin goals of the interior decorator today

An interior decorator is a creative artist Almost anyone can put furniture and rugs and lamps and curtains together in such a way that they will serve a need But a person who has not been trained as a decorator usually juggles together all the ideas he remembers from the radio newspapers movies and magazines Such hit-or miss methods may or may not secure the right effect A skillful decorator on the other hand knows how to produce the exact effect that he would like to have

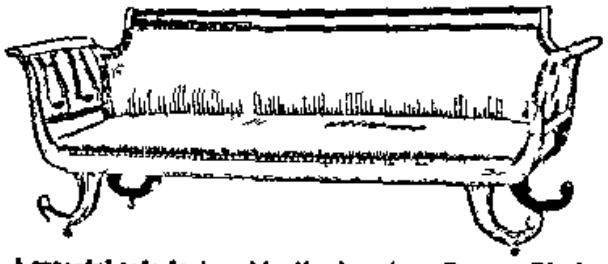
A decorator must have sound business judgment Only the decorator who is able to plan interiors within the client's budget will succeed

The aim of the interior decorator is to create the one background that will exactly suit the person for whom it was planned A task such as this can never be merely mechanical or cut and dried No two clients will be exactly alike nor will their needs and



U S Dept of Commerce

At left is a chair from Queen Anne's period the next three are named for their English designers—left to right, Chippendale Hepplewhite and Sheraton the one farthest right is an early American colonial banister-back chair



A graceful sofa designed by the American Duncan Phyfe

tastes be alike Each will have ideas that are different from other people s and each will have different amounts of money to spend

Suppose that you are an interior decorator and have one client who is fond of simple modern design and another who prefers the warmth and richness of old Spain These two people would require quite different backgrounds You should be in sympathy with their wishes and do your best to understand them

In few occupations does the personal element enter as strongly as in interior decorating The decorator must possess the ability to understand and handle people This means that he must be able first of all to make people like him He must be patient and fair He must realize that in working with people there are unavoidable mistakes and unaccountable delays Many clients change their minds from one minute to the next A decorator has to put up with all sorts of whims when he has clients who are not sure in their own minds what they want

If you decide to embark on a career in interior decorating you should try to have the very finest training Ideally you should have from two to four years of college with a fine arts major followed by two or three years at one of the good art schools where excellent courses in interior decoration are given As in all professions the reputation and scholastic standing of the school are important The more educational background and general information you are able to acquire the better equipped you will be for your job The location of your art school is important It should be near to art galleries museums industrial exhibits and established decorating centers

Travel is a most valuable supplement to a formal education If your mind is alert and your eyes are open travel can teach you a great deal about the cultures and backgrounds of other people

To complete your formal education you will find it most advisable to serve an apprenticeship with an established decorator Such an apprenticeship will help you to determine the type of work you can do best

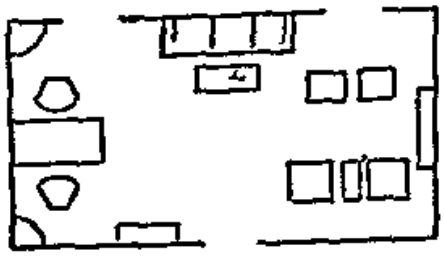
Having secured a good education and good training and having served his apprenticeship the young decorator may seek employment in one of the many fields open to him His first job might be in the decorating department of one of the great department stores After the newcomer has gained some experience he might become a decorator s shopper—a job that is great fun as well as excellent training Later he might be advanced to the position of assistant decorator and then decorator

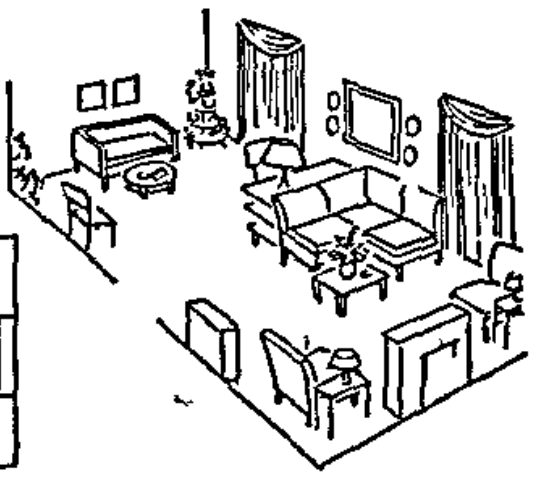
Experience will teach the young decorator whether his talents shine most brightly in styling home furnishings designing textiles furniture and accessories planning displays or in the allied fields of costume design stage settings and sales promotion projects

You should have years of successful experience in the field before you think of opening a decorating shop of your own In your own shop you will of course be in business for yourself and you must be sure that you have a good head for business if you want to make a success of it Business training is a very different thing from artistic training In the course of your decorating work you will need a good deal of business knowledge but if you decide to open your own shop you

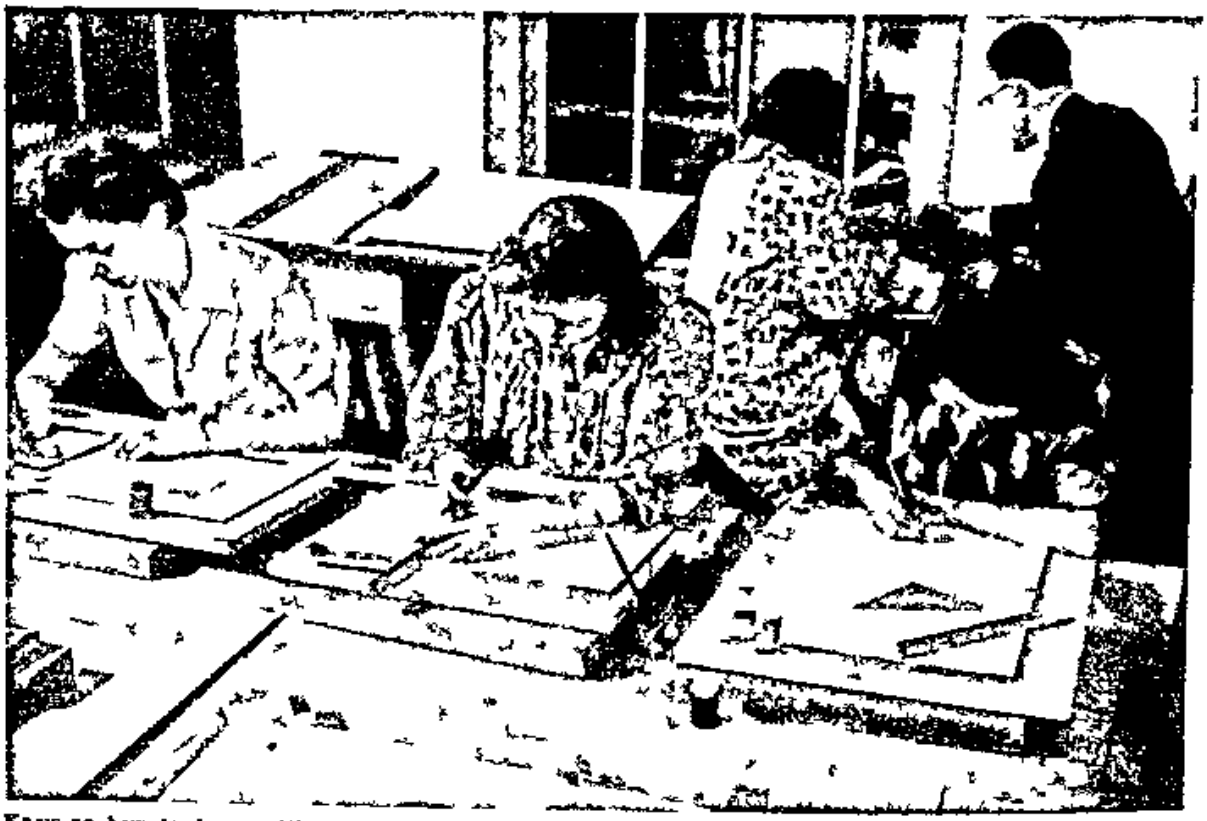
From Decorating for You by Florence B Tebbune, published by M Barrows and Company Inc

The ugly proportions of a long narrow room can be disguised by placing the furniture so that its long lines cross the room. The left arrangement is commonplace and accents the room s bad shape the other diagram shows the room transformed

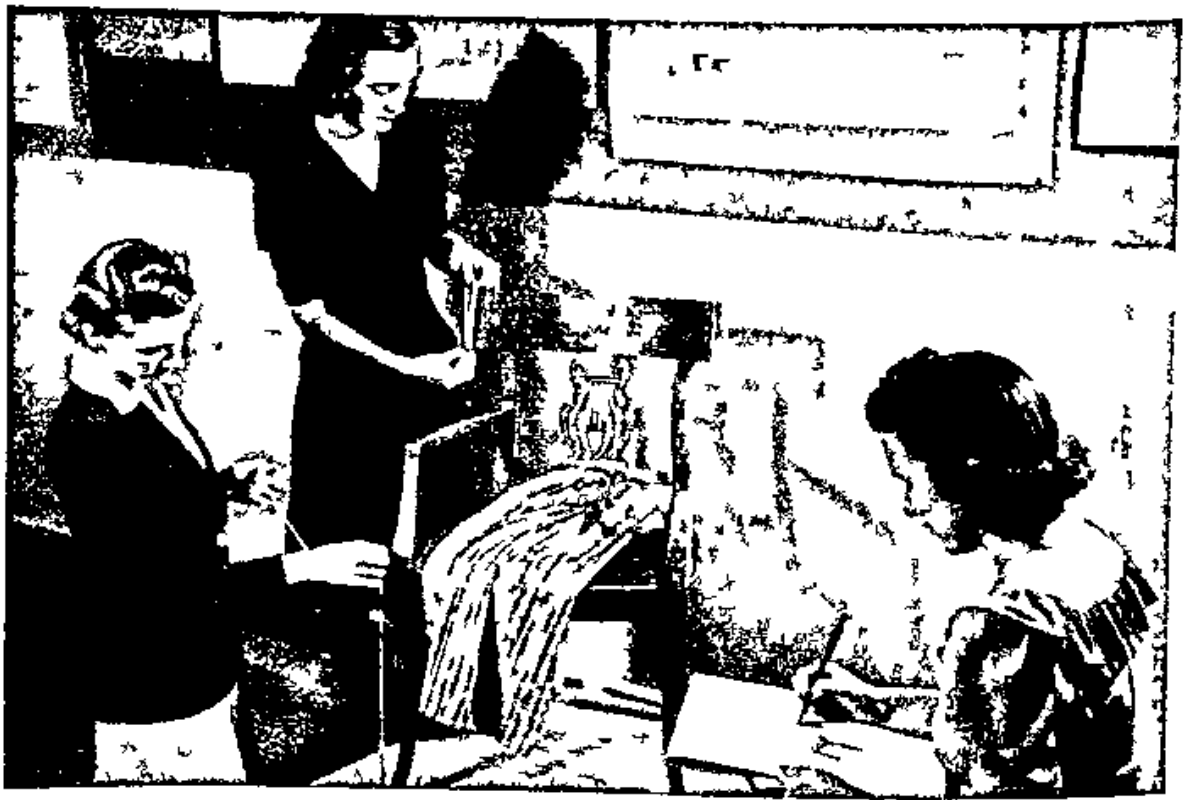




GRACIOUS ROOMS BEGIN WITH DRAWING



Know ng how to draw, with a good understanding of perspective is a valuable tool for the interior decorator These students are designing rooms in perfect scale and will add furnish ng details.



Bo h p c u es New Yo k School of In er or Decora on

The lines of an old French chair with a lyre back inspires these future decorators. Two girls take its exact measurements, while the other girl sketches a possible adaptation of the design for modern use



New York School of Interior Decoration

A swag valance is examined for its skillful workmanship Decorators must know both how to design and how to make draperies and slip covers

should take the time to make a special study of running and managing a business

After you have had training and experience in interior decorating you might choose to become a designer or a consultant to manufacturers If magazine or newspaper work appeals to you you might write articles about your work or accept an editorial position

There is so much variety in the many branches of interior decoration that the mind is constantly challenged and there is always an incentive for growth and achievement The completion of a formal education in this field is the real beginning of more and more interesting study The more you know the more absorbing your research will become You will need a fund of information on painting sculpture design and color the latest information on textiles rugs ceramics furniture plastics and on many of the newest developments of science and mechanics

A capable decorator is able to read and understand blueprints and layouts and he should be able to draw them himself If he has this skill he can make sure of achieving the exact effect he wants from the first to the last detail If he can do the actual drawing himself he will gain an understanding of scale line form and design which can be acquired in no other way Many of the problems of decoration are directly concerned with architecture and a basic knowledge of this subject—traditional and modern —is vital to the decorator

A decorator should know how to draw plans for structural changes in a house or in a part of a house He might wish to have cupboards built into a kitchen or he might wish to turn two small rooms into one good sized room by removing the partition between them Sometimes the addition of a fireplace will change the whole appearance of a room in such a case, a decorator should know whether or not it is practical to have a fireplace made Knowing how to make changes like these is a part of the business of any skillful decorator

Sometimes a decorator may be called upon to make sketches and plans for the manufacture of special pieces of furniture He should be able to supervise the making of each piece so that it will turn out to be just what he ordered The decorator may also create designs for fabrics rugs and accessories when he can not find what he wants on the market

A good decorator may be asked to decorate almost every kind of place where man lives or works or seeks amusement—hotels yachts stores office buildings and theaters Or he may specialize if he likes on all types of home decoration from city apartments to country estates

Interior decoration is one of the finest of careers that talented women can undertake and few other fields offer so many opportunities for enthusiastic capable persons whether they are men or women If you become an interior decorator you will need to use all of your abilities all of your knowledge and all of your understanding



ECONOMICS IN THE WORLD'S LIFE

By Graeme O'Geran

Department of Economics Syracuse University

ECONOMICS is the practical science dealing with the satisfaction of human wants The word economics comes from two ancient Greek words mean ng household pos sessions and managing The study of eco nomics the study of our human wants and their satisfaction is based upon two funda mental truths The first of these truths is that our wants are unlimited We are somehow never fully satisfied No sooner is one want satisfied than another appears Take your self for example At some time or other haven t you wanted say a new ball and bat for Christmas tell ng your parents that such a present would make you perfectly happy? Then perhaps even before New Year s you found yourself thinking that you could really play good ball if only you had a new ball suit or a pair of sp ked shoes Well we are all that way always wanting someth ng we do not have

The second great truth is that nature makes us struggle for most of the things we need or want Your father or mother must work in order to earn the money with which to buy the clothes you wear the food you eat and the things with which you play When you grow up you too will have to work if you hope to satisfy your wants

From the earliest times man s chief con cern all his life has been to supply his daily needs As a result of this struggle to make a living our ancestors passed through several economic stages Their passage from one stage to another was very gradual in some cases and more rapid in others

Man lived in the first stage f r perhaps thousands of years The people in some parts of the world remained in this condition much longer than did others For example some of the American Indians were in this stage when the civilized white men first landed in America In the first stage wants were met by taking fish from the lakes and streams wild animals from the forests The people owned no personal property as we think of it today Most of them had no permanent home and engaged in neither trade nor commerce Depending as they did entirely upon the raw materials of nature they would suffer a period of starvation and then enjoy a period of plenty and so their life would be lived This is called the Hunting and Fishing Stage

With advancing civilization and with in creasing wants man gradually began to do-mesticate wild animals The Old Testament describes a people in this economic stage surrounded by their flocks of sheep and herds of cattle This is called the Pastoral Stage Pastoral means feeding grazing The word pasture comes from the same Latin root

In the next period the Agricultural Stage man began to own land and slaves and he learned how to raise a number of crops So wealth began The people of England for example following the Norman conquest of 1066 advanced rapidly in the art of farming and some of them built up large agricultural estates

With the growth of trade and commerce following the Crusades in the Middle Ages agriculture came to be somewhat less impor tant in many sections of civilized Europe Men became skilled in making things with their hands and selling these things—cloth of various kinds shoes furniture and so on This period is called the Handicraft Stage

If some day you go to England you will

find that in London many of the ancient street names remain indicating the trades of the people living there in the years of the Handicraft Stage For example you will see there such names as Mason s Avenue Iron monger s Row and Shoe Lane

You and I live in the Industrial Stage of the world s life The Industrial Stage became *firmly established as a result of the Indus* trial Revolution which made it possible through many inventions, to do by machin ery work that had always been done by human and animal labor

This revolution (or change) took place in England between 1750 and 1850 it spread to many parts of the civilized world includ ing the United States Among the most im *portant inventions were Hargreave s spinning* jenny, Cartwright s power loom Whitney s cotton gin to separate the seed from the raw cotton—and probably the most important of all Watt s steam engine

The results of these great inventions changed the way of living for millions and the change kept spreading and is still spread ing More things could be made at less labor *and less cost The modern Factory System* came into existence Trade and commerce *were extended to far parts of the earth Then* men discovered that they could accomplish more by Division of Labor about which we shall soon speak We said that economics is concerned with the satisfaction of human wants Things which satisfy these wants are called Goods The bread we eat the clothes we wear the air we breathe are all goods

There are two kinds of goods Those which exist in great quantity relative to the demand are called Free Goods Air water and sun shine are examples of free goods Not only are they exceedingly useful they are neces sary to life itself Yet under ordinary condi tions we do not pay for them since they exist in abundance and may be had for the taking

Those goods which do not exist in suffi *cient quantities to meet the demand* are called Economic Goods Unfortunately most of the things that satisfy our wants are of this kind they are scarce and require effort to make them or money to pay for them

Useful services even though they are not materials or things are clas ed as economic goods The policeman the minister the operator of a bus and the teacher all render *services which are just as much economic in* character as those of the carpenter or shoe maker

What is wealth? We commonly talk of wealth as meaning riches the possession of much property A poor man is one who has few things or little wealth while a rich man is one who has many things or much wealth

But in economics we use the word without *reference to quantity In general we consider* wealth is a group or collection of economic *goods Wealth consists of all tangible things* which satisfy human wants which can be transferred or exchanged and which because they are limited in supply have value in exchange

The study of economics is so much con cerned with wealth that it is often defined though not quite truly as the science of wealth its production and distribution



Cou esy Am can Museum of Na u al H s o y New Yo k

American Indians lived in the Hunting and Fishing Stage longer than most peoples. Here they hunt wild buffalo



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Courtesy American Museum of Natural History New York

American Indians lived in the Hunting and Fishing Stage longer than most peoples Here they hunt wild buffalo

To repeat *Wealth is a group of economic goods It is limited in supply transferable and useful in satisfying human desires* Study this definition carefully Sometimes very injurious things are produced and bought and sold Often goods of inferior quality are made for a poor market Economics studies the best means of increasing the quantity of goods and commodities in their distribution It is the business of art and education to see that the wealth produced is good in kind and such as will make people happy comfortable and cultured In the same way when we study engineering we are concerned solely with the making of machines and not with the quality of the goods the machine will be employed to manufacture A good loom may be employed to weave a poor cloth but that is not the fault of the loom So economics when it deals with producing or exchanging commodities treats them all as wealth

A KNOWLEDGE OF THE LAWS OF ECONOMICS IS IMPORTANT IN MAKING A LIVING

It is very important if the greatest happiness is to be secured for the greatest number of people that we should understand the laws governing the production and distribution of wealth If we do not understand these laws we are likely to make big mistakes and to bring suffering on others Strange as it seems even nations have by not understanding economics made great mistakes in government which have made millions poorer than they should have been The study of economics too is becoming increasingly important because getting a living is growing more and more complicated

Getting a living was very easy to understand in the past up to about 150 years ago Few machines had then been invented and the things made were for the most part manufactured from beginning to end by individual workers In making a suit of clothes one man cut and fitted and sewed and made buttonholes He performed every necessary process The same thing was true of almost every occupation Each worker carried his own job through from start to finish The greater part of trade was carried on near home and people knew what was to become of the food they were raising and of the things they were making

SPECIALIZATION IN THE FIELD OF LABOR HAS BEEN DIVIDED INTO FOUR FORMS

Now all that has changed as a result of the Industrial Revolution The machine takes the place of human labor in many steps And since machines can usually work faster than human beings there is a great increase in the kinds and quantities of things produced Things can be cheaply purchased which formerly were made at home—soap for instance Workers specialize To this specialization the economist gives the name Division of Labor which has taken four forms

1 *Occupational Division of Labor* Long before the Industrial Revolution individuals and families began to specialize in particular occupations One family would concentrate on farming another on the making of shoes another on grinding grain for making flour another made clothes and so on Then an exchange of products took place so that everyone had all the necessities of life As a result of this occupational division of labor, things were not only made better but also made more cheaply since concentration on one job increases skill in that job and speed in getting it done Thus more articles can be made in a single day or week This means a smaller cost for labor on each article

2 *Division of Labor within an Industry* Then occupations began to be broken down into parts especially after industry left the home and concentrated in factories For instance in the clothing industry, one concern would specialize in men s suits another in hats another in socks and still others devoted themselves to making women s dresses suits hats and so on Likewise specialization developed in professions For instance nowadays one doctor looks after our eyes another after our ears another after our stomach and still another sets the bone if we fall and break an arm

3 *Specialization by Task* Still using the clothing industry as an example we find that a large number of workers are employed in the making of different parts of a man s suit One does the measuring another the cutting another the sewing another makes the button holes and others sew on the buttons

4 *Territorial Division of Labor* When heavy machinery began to be used in England in the second half of the eighteenth century another change took place Coal was needed to run the machinery It was wise to build factories where coal was abundant so that the fuel would not have to be hauled for long distances The areas without coal engaged in agriculture and bought iron cotton and woolens from the manufacturing districts For various reasons other districts specialized in different trades For example

Belfast in Northern Ireland made linens because flax was grown near by In the United States, the steel industry developed in places near coal yet close enough to water ways so that iron ore could be brought cheaply to the coal for smelting In Alabama



Culver Service

In the Pastoral Stage man began to domesticate and herd wild animals

The Bettmann Collection

The Agricultural Stage saw man turn to cultivating crops with tools such as the crude plow shown in this picture

coal and iron are found close together that is an ideal situation Cotton mills are found in the southern states, where cotton is grown

5 *International Division of Labor* There is a division of labor not only among persons among trades and among districts but also among nations This arises for exactly those reasons which cause different trades within a country to be carried on in different parts of it A country may specialize in an industry because of certain natural resources or climate China's silk industry grew for example because the climate was just right for mulberry trees to thrive and silkworms eat mulberry leaves The people of a country may develop a special skill and so an industry will grow there—as, for instance watch making in Switzerland and lace making in Belgium

For these reasons the nations of the earth are becoming more and more dependent on each other To encourage this specialization and the exchange of goods between countries two great meetings attended by representatives of many nations were held in 1944 One was at Bretton Woods New Hampshire to make plans for post war trade and commerce and the other at Dumbarton Oaks Virginia to plan for a lasting peace

All wise men know that specialization between nations is good only in time of peace In wartime each nation must strive to satisfy the needs of its people without looking outside its borders (or the borders of its Allies)

Adam Smith an Englishman laid the foundation for our modern study of economics His great book THE WEALTH OF NATIONS was published in 1776 It describes three advantages arising from the division of labor

1 The increase in dexterity and skill of each particular workman 2 the saving in time because a workman no longer has to



Courtesy New York Public Library

Shoemaking in olden times was done by hand Here a cobbler (shoemaker) works at his trade



By Ewing Galloway New York

A machine stitches shoes at a modern factory

thing to another if the worker has to make the whole of an article or to employ different processes and materials there is necessarily much time wasted in laying down one job or one tool and taking up another and clearing up after one job and preparing for a different kind of work

To illustrate how the division of labor leads to invention Adam Smith told the following story of a boy who worked at a steam engine

A boy was constantly employed to open and shut alternately the communication between the boiler and the cylinder according as the piston either ascended or descended

One of those boys who loved a play with his companions observed that by tying a string from the handle of the valve which opened this communication to another part of the machine the valve would open and shut without his assistance and leave him at liberty to divert himself with his playfellows

One of the greatest improvements that has been made upon this machine since it was invented was in this manner the discovery of a boy who wanted to save his own labor

pass from one job to another 3 the stimulation of invention

As to the first of these every child has experience To become expert in swimming or in playing the piano we must give much time to practicing The constant practice of a particular thing makes it become second nature Thus the person devoted solely to one occupation is far more useful than if he were a jack-of all trades

As to the saving of time in going from one

Adam Smith is even more right on this point now than when he told this story Nowadays in great manufacturing establishments there are machines to do almost every part of the work quickly and with a minimum of attention from the operator

Along with the great advantages we have seen resulting from the division of labor there are some results that are far less de-

sirable One of the chief of these is the *monotony which comes with doing one par* ticular task or watching a machine do one small task day after day and year after year, maybe for a lifetime

Such tedious work produces a deadening effect upon both mind and body and may cause an individual to lose interest in the job Such concentration can not help but destroy pride in master workmanship

The remedy for the monotony is to be found in shorter hours of labor which give the individual a chance for recreation or for *some form of individual work or hobby*

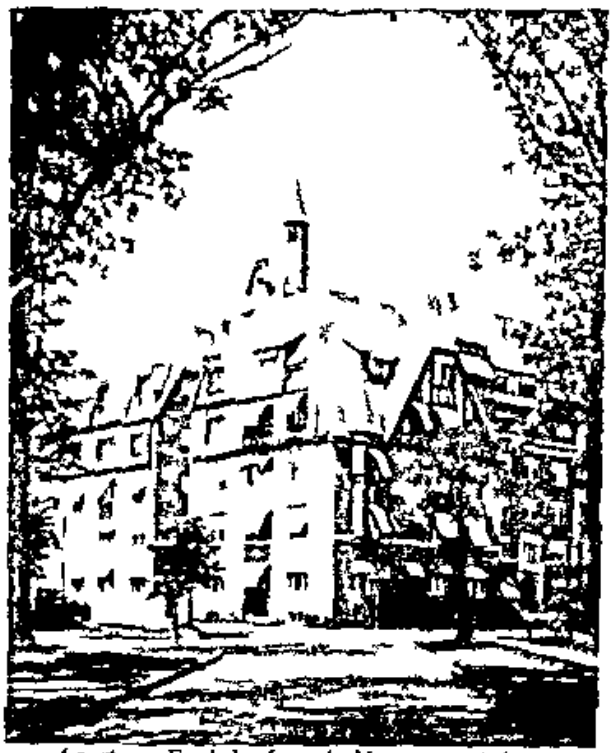
It is true that hours of labor have in gen eral grown shorter as the machine age has grown older

HOW WEALTH IS CREATED

We are now ready to take a closer look at wealth What is wealth? It has been defined as a collection of things limited in supply transferable and useful in satisfying human desires We may go further and say that wealth to most of us means possess on of things over and above the amount needed for bare living from day to day A country has wealth if enough of the people have a good store of sound money or other possessions A country has potential or unused wealth if it has stores of minerals or forests or other gifts of nature that have not yet been worked

Wealth is created through what the econ omist calls the process of production Pro- duction takes place when a commodity is shaped into a desired form taken to a place where it is wanted at a particular time and purchased by a consumer who believes it will satisfy some particular want For example the wheat farmer raises the grain the miller changes it into a useful form—flour—the railroad carries the flour to a place where it is wanted when it is wanted while the mer chant performs the service of getting the flour into the hands of the baker or the housewife who converts it into bread for im mediate consumption All these people are producers So you see that anyone who makes a commodity more useful is a pro ducer If in doubt as to whether any person is a producer or not just ask the question is someone willing to pay for the product he turns out or the service he renders? If the answer is yes then he is according to eco nomics a *producer*

From the beginning of time man has se cured a living from the soil For ages even to exist meant a continuous struggle Ex



Courtesy F ed F F nch Management Company
An apartment house owner is a producer of a service

istence was possible through the combined forces of two *productive factors* or agents— *nature* or *land* and *human labor* With the long passing of time a new and very impor tant factor in production appeared—*capital* Later as the Industrial Revolution spread *from Europe to other parts of the world* a fourth factor became very important To this new factor is given the name *enterpriser* Now let us see the part played in production by each of these factors and why each is so important in modern economic life

1 *Land* or *nature* is that wh ch provides us with standing room in which to work and play materials and forces In the science of *economics land means far more than just* soil It includes as used in th s broad sense everything above the earth as air every thing upon the earth as soil trees rivers and lakes and all that is under the earth includ ing rocks and minerals When we include forces in our definit on of land we are re ferring to such things as electricity and the law of gravity In economics all these things *are included under the term land*

2 *Labor* By labor as a factor of produc tion is meant the appl cation of our *mental* and physical powers to the materials and forces of nature in the creation of economic goods or wealth

Labor is usually considered as of two kinds physical and mental The physical

workers are likewise divided into two classes, the unskilled as the pick and shovel worker, and the skilled worker, as the shipbuilder, boiler maker and automobile mechanic

There are also two groups of mental workers First, the *routine* worker, such as the average bookkeeper or store clerk Second, there is that much smaller though very important, group known as the *inventive* class of labor To this class belong the expert accountant the store manager and your school principal as well as such men as Eli Whitney, who invented the cotton gin and Thomas Edison

WEALTH TENDS TO GROW BY SAVING LABOR AND BY INCREASING ITS EFFECTIVENESS

It is not the amount of labor we do which creates wealth but its effectiveness Man is a small creature much weaker than many of the higher animals but his muscles are directed by his wonderful brain It is a common error to speak of labor as the source of wealth The truth is that all the labor in the world would be of little use unless it was used in co-operation with the other factors of production—land, capital and management It is equally true that wealth increases, not by increasing labor, but through saving labor

As long as man worked with his own hands or with the aid of a few simple tools and weapons he spent nearly the whole of his life in obtaining a scanty supply of food No matter how rich the territory he inhabited he could not become wealthy or enjoy much comfort or culture A striking example of this is the United States which supports about 140 000 000 people Not very long ago in the world s history, this territory with all its wonderful wealth of rich prairie land, timber, fine rivers natural ports and magnificent stores of animals, was the home of a small number of men, most of whom hunted or fished or scratched for a scanty living and failed to create wealth because they did not know how to make the best of the natural gifts about them

THE INVENTIONS AND DISCOVERIES OF ALL HISTORY ARE THE WORK OF BUT A FEW MEN

But when labor is aided by the inventions and discoveries of clever men and exercised in a properly organized way, the possibilities of wealth production are almost unlimited We of today are very fortunate we are the heirs of all the ages—the inheritors of the work and genius of every great man and woman of every nation We have a greater opportunity than ever to create more wealth

Now here is a remarkable thing The great inventions and discoveries in history have been the work of a few gifted people Even if we include the small inventions, the number of people to whom we are indebted for the modern means of making wealth amounts to a tiny fraction of the billions who have lived on earth If we are ever tempted to be proud of using such inventions as the electric light, or the railway train, or the steamboat, or the radio, let us remind ourselves that we did nothing to bring them about and that we can at least use them intelligently

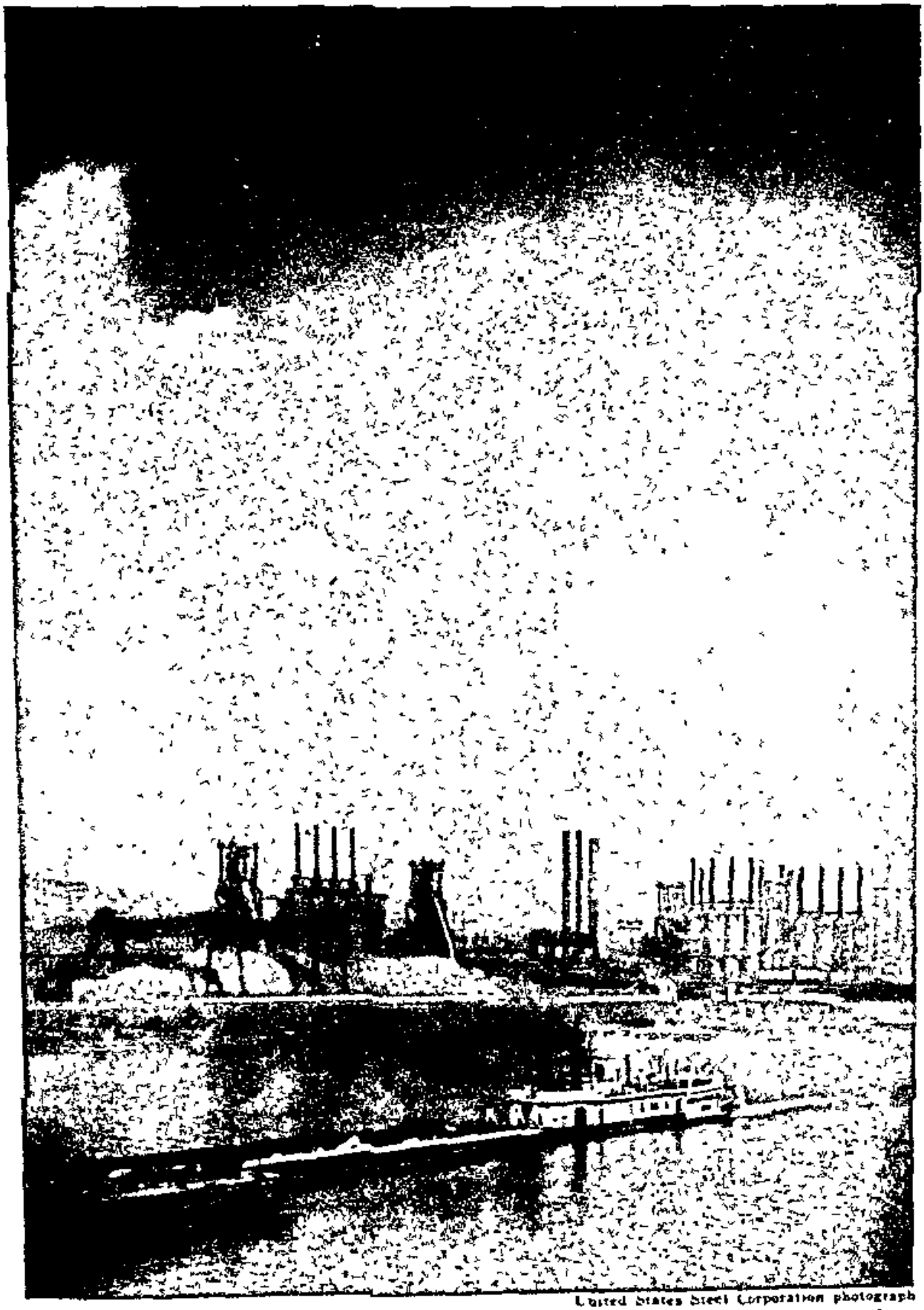
We have seen how labor is divided among individuals, among trades, among territories and among nations in such a way as to get the best results By organization we can make ordinary people as effective for many purposes as if they were very clever indeed while we can raise the value of all the people concerned, whether individually clever or not

THE FRUIT OF ONE MAN S INVENTIONS MAY ENABLE MANY MEN TO WORK MORE CLEVERLY

Suppose a man invents a tool If he remains the sole user of the tool, the value of his clever brain is confined to the one possessing it, himself If however, he shares the secret of his tool with others, each one who has it at once becomes a clever worker, by use of a tool he could not have invented for himself So men become, as it were, clever at second hand

3 *Capital* is produced wealth used in the production of other wealth From this definition it can be seen that all capital is wealth but that all wealth is not capital Land is wealth but certainly it is not capital That is because land is not produced, it is a gift of nature Capital is the result of human effort, requiring both waiting and sacrifice

The following story may illustrate what we mean In early times a man might have kept his family fed by fishing all day long with hook and line But one day he might have taken time to build a net, while living on half rations for the day Going out the next morning he would find that within the space of a few hours, by means of the net he could catch far more fish than he had caught previously by working all day Through sacrifice and waiting capital was created in the shape of a net The farmer who puts aside a portion of one season's income in order to buy a new plow is creating capital in the very same way He buys the plow in the belief that spending his money for it will result in increased production



United States Steel Corporation photograph

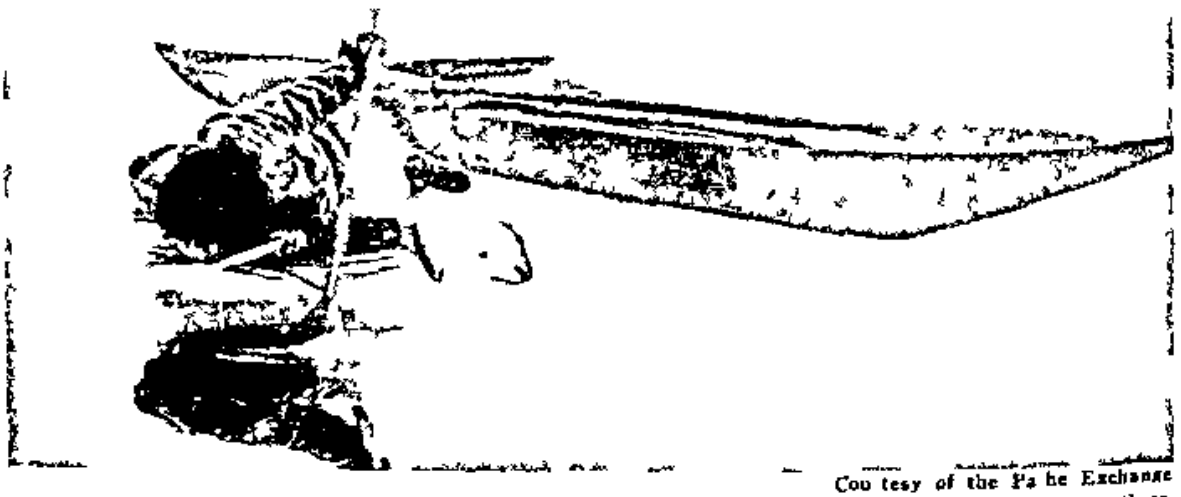
The coal on these river barges is mined in the area containing the steel mills shown in the background.

Capital has vastly aided human progress We have seen how inventions have multiplied the powers of man making men even if not clever themselves the users of clever things It is important to understand however that if someone did not take the trouble to store up capital in the shape of machines and instruments (inventions) the inventions could not be used

Suppose someone invented a cheap method of extracting from clay the shining white metal aluminum which it contains That would indeed be a tremendous service to all mankind because aluminum is not only beautiful but useful Such an invention would make a very great difference to the powers of men and we could employ aluminum for a thousand new purposes However the new process could not be used unless somebody found the means to set up the inventor's clever machinery Someone must find the capital to utilize the new invention or the invention does no good

Let us consider the railroad that passes through the city or town in which you live A train is a marvelous thing though most of us are so familiar with trains that we feel no astonishment at seeing a great locomotive drawing a long procession of cars over the rails A number of clever brains thought out the ideas which are used in making a modern train Stephenson invented the railway engine Westinghouse invented means of checking the speed of a train by air brakes Pullman gave us the modern dining and sleeping cars Perhaps a hundred other inventors improved upon the basic designs and millions of people every year ride on the railroads Many enjoy the inventions of a few

Yet no matter how clever the ideas the railroad could not have been if some people had not stored up money to manufacture locomotives and trains to erect buildings to hold engines and cars when not working repair shops, tracks and ties and offices in which to control the whole undertaking These things form the capital of the railroad They embody the inventors ideas Once more we see that labor becomes fruitful when capital makes it possible to put inventions to work



Courtesy of the Pathe Exchange

An Eskimo's canoe represents one of the chief elements of his private capital. His sledge and dogs are others.

The Eskimo's sledge his dogs his canoe his knife are his humble capital or stock These are the result of his careful saving and if he did not thus save he would perish The principle is the same in civilized, communities We have learned to exchange goods with each other by means of *money* By money we measure the value of things by a common standard and money enables civilized men to save up work in a convenient way Money acts as a *storer* of value Instead of saving up hats if we make hats—or automobiles if we produce automobiles—we can save up money The money we can either use ourselves or lend to others to establish stocks of capital with which to use inventions and to enable persons to be usefully employed in working on inventions

Thus *saving* becomes very important for without it all the clever inventions of machines and appliances would be useless It

would have been in vain for Watt or Stephenson to invent the locomotive if people had not been found willing to lend money to make enough engines to run a railroad It would have been in vain for men to invent radio if enterprising and saving people had not come forward to put their money into broadcasting stations and equipment, through which programs are brought into your home, and may reach every corner of the world Now we see clearly what capital is It is a stock of *produced goods* resulting from saving and if no one saved, there could be no capital

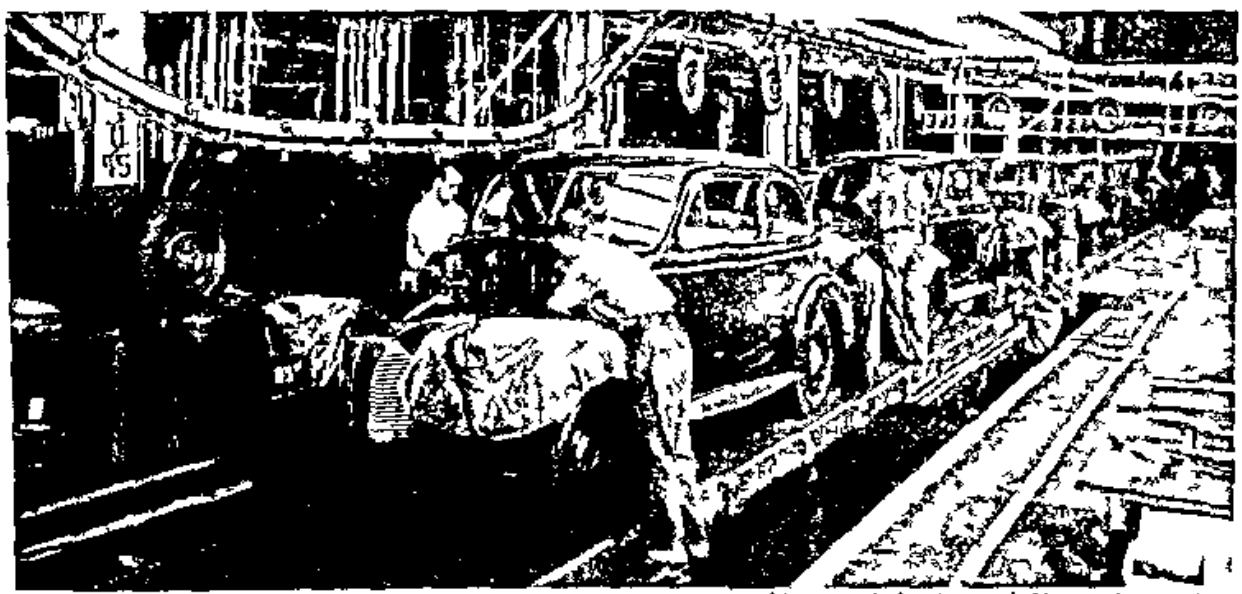
The person who saves and owns capital is sometimes called a capitalist He may be either a man who has saved to form a business which he himself will organize or he may be one who, having nothing to do with the business himself, has lent the money required to buy the machinery, equipment and raw materials needed to run the business

4 The *enterpriser* is the fourth factor of production Before the Industrial Revolution the factors of production were not separately owned One man owned the land and provided the labor and the capital to carry on his business Most of what a family consumed was produced within the home Problems of labor and capital were absent

However, with the coming of machinery, one person came to have labor to sell, another land to rent, and still another capital to invest These factors were unorganized until the *enterpriser*, or business man assumed the task of unifying them in order that production might be properly carried on The enterpriser assumes the risks for the success or failure of the business He must make the decisions as to the amounts of land labor and capital necessary in a given plant or industry

This co-ordination of factors may be more clearly understood by studying a large corporation, as for example a great telephone company The wires switchboards and buildings represent the capital The land provides the space for buildings and equipment The managers linemen and operators represent the labor factor The stockholders and their chosen officers constitute the enterprisers upon whom the final success of the industry rests They are the ones who receive what profits are made, and they are the people who must shoulder any losses

This illustration should make it clear that no one factor in production is more impor-



Photograph by General Motors Corporation

An automobile assembly line illustrates the specialization by task method A man does only one particular job

tant than any of the others No industry can carry on without the combined factors working together smoothly and in proper proportions Any attempt to place greater importance upon one factor, as for example, capital, or labor, would be about as difficult as to try to determine which cutting edge of a pair of scissors does the cutting or which leg of a three legged stool is most important

As we have discovered, the *enterpriser* is a man with imagination He recognizes a business opportunity neglected by others He may be a Ford who first saw the importance of a low priced automobile, a Firestone who developed the rubber industry, a Woolworth,

who recognized the opportunities in five and ten-cent stores or perhaps your father who was the first to sense the need in your home town for another bank a new store or a particular manufacturing plant

THE BUSINESS UNIT MAY BE SOLE OWNERSHIP PARTNERSHIP OR A CORPORATION

No matter what the field of activity the enterpriser is successful if he succeeds in producing a commodity or rendering a service for which the people are willing to pay a price high enough to return a profit He is the one who organizes the productive factors into what the economist calls a business unit which has as its purpose the making of profit through the production of wealth

The business unit may take any one of three forms (1) the sole proprietorship (2) the partnership or (3) the corporation

1 The *sole proprietorship* exists when one person organizes manages and takes full responsibility for the success or failure of the business He must provide the land and the capital hire the labor and direct all the productive operations By far the greatest number of business organizations are of this simple type yet it accounts for only a small proportion of the capital invested in business and the number of laborers employed in the United States

SOLE PROPRIETORSHIP IS POPULAR BECAUSE IN THIS CASE A MAN IS HIS OWN BOSS

The very fact that the sole proprietorship is easy to organize has made it popular There are no complicated legal requirements to be fulfilled or payment of heavy fees to the state The sole proprietor also knows that the harder he works the more he is likely to earn and that all the earnings go to him There are no partners or stockholders with whom he must share his earnings Finally there is no red tape connected with the operation of the business Suppose for example, one of your neighbors owns and operates the leading clothing store for men in your community He is perfectly free to buy as large or as small a supply of suits or shirts or ties as he wishes He may spend money for advertising as he thinks best extend credit to customers or require cash open and close the store at will and even go out of business solely on the basis of his own judgment In short he is his own boss

He does however face some serious disadvantages In case the business fails he is held liable for all the debts All his personal savings and possessions may be taken over to pay rent and wages that are owed and for the merchandise he has bought from the wholesalers Another disadvantage is the difficulty of getting together large amounts of capital Rarely can a business man by himself secure sufficient funds to enter business on a large scale This may prove a great handicap when competition is keen or in periods of depression when reserves are necessary to tide the business man over the slack period when trade falls off and not enough money is coming in to meet his current costs of staying in business

2 The *partnership* A partnership exists when two or more persons by mutual agreement organize manage and assume the risks of business It is customary for those forming a partnership to draw up a written agreement setting forth the terms upon which the business will be run the amount of money or capital each will put into it and how the future profits are to be divided up among the partners

BOTH MEMBERS OF A PARTNERSHIP ARE RESPONSIBLE IN THE EVENT OF FAILURE

This type of business unit has certain advantages over the single proprietorship To start with it is easier to get the necessary capital Where two or more business men join together in a business undertaking they are usually able to pool a much larger sum of money for business purposes than could the sole proprietor There is also the added advantage that comes from pooling their abilities and judgment You know the old saying "Two heads are better than one"

The greatest drawback to the formation of a partnership appears when such a business venture fails Then each one of the partners is held individually liable for the total liabilities of the partnership in case the other partners are not able to assume their share of the debt This could of course completely ruin a person and place on his shoulders a debt which could prove a lifelong burden

The partnership is popular as a form of business organization with small merchandising firms in the trades and among doctors and lawyers The next time you go downtown look at the signs above the shops and offices you pass No doubt you will be surprised at the number which read something like this Smith and Smith Hardware Store Jones and Brown Grocery or Graham and Hirsh Lawyers

3 The *corporation* Most large businesses and many small ones prefer to organize as corporations A corporation is an imaginary

or artificial person created by law for some particular purpose That is under the law the corporation has the same rights and privileges as does an individual The persons who own the business are not the corporation but merely represent this legally created individual, and carry out the rules and regulations which the state grants the corporation at the time of its creation The privileges are granted in the *charter* which is received from the state in which the business is incorporated

The corporation raises money for organizing and carrying on a business in two ways First, through the sale of stock which is a share or interest in the corporation If for example, your father should buy a share of stock in the telephone company, or a local bank or factory, he would receive a receipt for the money he paid This receipt would be a piece of paper stating the number of shares your father bought on a certain date and bearing his name as owner Such a receipt is called a *stock certificate* Ask your father if he owns such a certificate, if he does ask him to let you see what it looks like



John Brown is the sole owner of the first business unit and a partner in the second The third is a corporation

When a corporation makes good profits a part of this money belongs to the owners of its stock certificates who are called stockholders It is distributed to them according to the number of shares they own These distributed profits are called dividends When a corporation is not making money, there are no profits and so there will be no dividends If the corporation fails the shares will be worth nothing at all and the owners of the shares will lose all they have invested in them

Many people do not wish to risk their savings in the purchase of stock For them a much safer investment is offered in the form of bonds A bond is a note of a corporation given in return for a loan of money, pledging to return the money at a stated future time, and also agreeing to pay a certain rate of interest at regular intervals usually twice a year Most large corporations at some time or other use this method in order to raise additional money for carrying on the business National governments also use this method to secure funds when more money is needed to carry on the government than is raised by taxes

The corporation form of business organization enjoys several distinct advantages the most important of which is *limited liability* This means that if the business should fail the loss to any stockholder is limited to the amount invested He can not as in a partnership be compelled to make additional payments in order to meet any outstanding debts Another advantage is to be found in the ability of the corporation to gather together much larger sums of money for organizing and operating the business

An excellent illustration is provided by the American Telephone and Telegraph Company Its capital investment amounts to many millions of dollars Yet to share in its profits a person need buy only one share of stock This shows how a large number of people may each place a small amount of money in a corporation and so create a large capital fund with which to do business

The major disadvantage of the corporation is that the holder of a share of its stock must assume the risk of losing what he paid for it This is the chance he takes Over and against this risk of course is the possibility that he may receive very large profits. Unless a person can afford to lose his investment he should not purchase stock

We have just seen how the arrangement of the factors of production in such a fashion as to make them fruitful is a very important thing and not every one has the gift of happy arrangement We owe a good deal to these enterprisers who can organize and put into work the best processes and inventions

Organization and invention between them save work and in saving it set labor free to do other work This is a most important economic truth For its neglect we pay in poverty and distress

Let us think of a hundred people working on an island and entirely dependent on their own labor If the labor of all the hundred is needed to find enough food to keep them alive that food is their sole wealth They can possess nothing more because all their efforts are needed to feed themselves and they must eat or die Therefore in such case they can not have clothes or houses or furniture or any other comforts

But suppose clever ones among them invent good weapons with which to hunt—weapons so effective that only fifty people are needed to feed the hundred islanders In that case the work of fifty food-getters is saved and therefore fifty persons are set free to do other jobs The fifty being freed can set to work to construct huts and make garments The little community becomes richer not because more work is done but because a particular form of work has been saved

Suppose the fifty remaining food getters by further inventions become twenty five Then twenty five can produce the food needed by the hundred islanders and seventy five are free to do other work The islanders become richer *because work has been saved*

IT IS ONLY BY SAVING WORK THAT WEALTH AND EMPLOYMENT CAN BE CREATED

This process of *saving labor* is just as true in a great nation as on the little island we have imagined A nation can become richer only by means of organization and invention continuously *setting labor free* to do fresh work That is why the idea of making work is a fallacy—a deceptive thing Sometimes workmen are tempted to think that if they spin out a piece of work or refuse to use a labor-saving machine they will make more work for others The very reverse is the truth. It is only by saving work by using inventions as freely as possible that we can make things better for other people He who makes work in the sense of taking an unnecessarily long time to produce a thing makes poverty He who saves work in the sense of producing as quickly as possible and as much as possible with the least amount of labor expended creates wealth and more employment

TECHNICAL IMPROVEMENTS MAY CAUSE UNEMPLOYMENT BUT IT IS USUALLY TEMPORARY

It is quite true that a machine which saves labor may throw men and women out of work for a time This is sometimes called technological unemployment which means that people are unemployed through no fault of their own Other work for them may not be found at once and this may cause considerable suffering This is especially true if inventions come very rapidly in old industries and no new industries arise at once

Fortunately technological unemployment is usually temporary In the long run inventions open up new opportunities for workers not alone in manufacturing but in other occupations as well For example back in 1900 about one million persons were employed in jobs closely related to the horse and buggy However with the coming of the automobile the carriage and wagon makers the local blacksmith harness maker and feed store owner were put out of business These were examples of technological unemployment. But as a result of the rapid growth of the automobile business by 1938 those engaged in producing selling and servicing the automobile employed almost 6 500 000 persons Likewise throughout this entire period rapid technological strides were being made within the automobile industry itself Instead of destroying jobs they created many new ones. This is but one of many examples that you may discover to show that by the use of labor saving devices both wealth and employment are increased

Thus we have examined four things which we speak of as Land Labor Capital and the Enterpriser, the four chief factors in the production of Wealth Land as covering all the gifts of Nature which man may either use or neglect Labor, as covering all human effort Capital the saved stores without which our labor is in vain and the Enterpriser who gathers the other three factors together and puts them to work in the proper proportions so that they may produce most efficiently Because these factors of production have worked together so efficiently over the years the people of the United States and Canada have more wealth and a higher standard of living than those of almost any other country in the world



S gna Corps pho o

Troops of the 3rd Armored Division U S First Army in Cologne Germany Background Cologne Cathedral

★ ★ EUROPE ★ ★

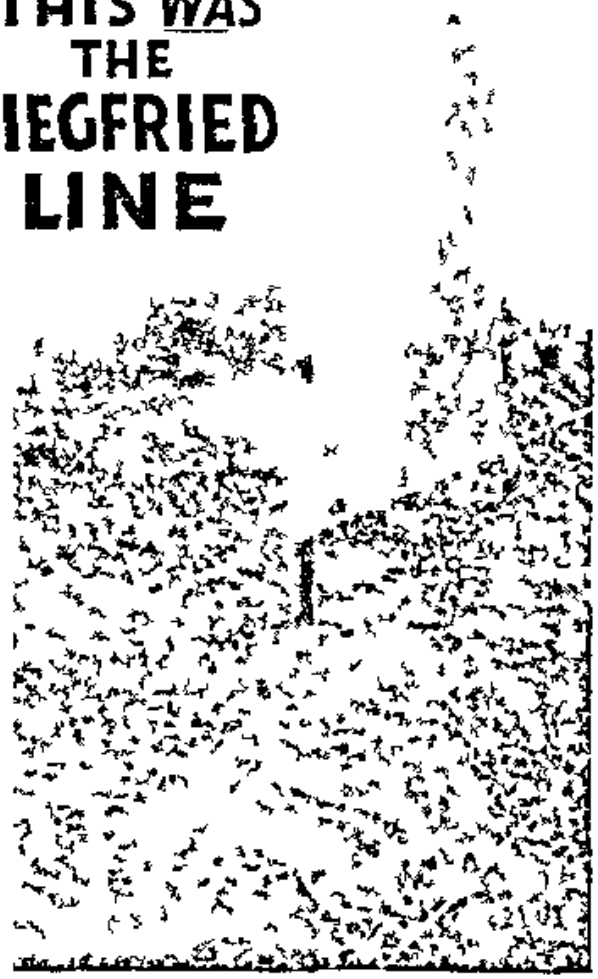
THE year 1945 marked the final l bera tion of Europe from nazi rule The Germans had reached the height of their power in September 1942 when their troops stood before the Russian city of Stalingrad on the Volga River Norway Denmark Bel gium Luxemburg the Netherlands France Poland Czechoslovakia Yugoslavia Greece and Austria lay prostrate at Germany s feet (Czechoslovakia and Austria had been occu pied before the beginning of World War II) Russia s s tuation was desperate in 1942

Italy Hungary, Bulgaria Rumania and Finland were Germany s obedient allies Of the neutral states Spain and Portugal were fascist countries and friendly to Ger many Democratic Sweden an l Switzerland hemmed in by the Axis were helpless Eire (Ireland) was determ ned to have nothing to do with the war Flushed with success the Nazis openly boasted of the New Order that they would bring to Europe

By the beginning of 1945 Germany s hold over Europe had been broken Four of her all es—Italy Rumania Bulgaria and Fin land—had been forced to surrender The Russ ans had penetrated into Poland and Czechoslovakia in the east and Yugoslavia in the south British troops had occupied Greece The Allies had driven the Germans back to the valley of the Po River in Italy In the west almost all of France Belgium and Luxemburg as well as the southern part of the Netherlands had been freed from the grip of the Nazis

Germany s cities had been pounded mer cilessly from the air by huge fleets of Ameri can and British bombers Large areas of Berl n Leipz g Essen and other large cities lay in ruins Germany s war industries had been battered her transportation system had been seriously damaged Already, too German soil had been invaded The Sieg fried Line the main nazi defensive barrier

THIS WAS THE SIEGFRIED LINE



Canadian Army Overseas photo

Canadian troops driving ever deeper into Germany showed their sense of humor when they put up a sign of their own on the far famed Siegfried Line

in the west had been cracked at several points the great cities of Cologne and Aachen were in Allied hands

The Nazis had launched a last desperate counter-offensive in December 1944 They had plunged through a weakly held part of the Allied line and had advanced deep into Belgium and Luxemburg But this fierce attack had been stopped at Celles near the Meuse River The Nazis had held up the Allied advance for a time but they had exhausted their own reserve strength

As 1945 opened German advance units were still deep in Belgium The Allies now brought up fresh reserves and overwhelming air power By the middle of January the nazi troops were fleeing eastward under a perfect hail of Allied fire to the shelter of the Siegfried Line

The British and Americans now continued their invasion of western Germany By the first week in March several Allied armies had reached the west bank of the Rhine River The Germans began destroying the bridges across the river It seemed certain that the Rhine would be a formidable barrier

A FAMOUS CROSSING—THE HINDENBURG BRIDGE AT REMAGEN MARCH 8

Yet it did not hold the Allies back very long On March 8 an American force crossed the river at Remagen over the Hindenburg Bridge which a careless officer had failed to blow up The Germans rushed reserves to the Remagen area But in so doing they weakened their defenses elsewhere along the river

On March 24 the British Second Army and the American Ninth Army succeeded in crossing the Rhine at a considerable distance from Remagen The Allies now launched a *Blitzkrieg* or lightning war—a type of campaign that the Nazis had introduced in Poland in 1939 It was a *Blitzkrieg* in which planes tanks and infantry all played an important part By the first of April Allied columns had plunged deep into Germany

In the meantime the Russian steam roller had ground ahead steadily in the east By January 18 one of Russia's armies had reached the German border province of Silesia At about the same time another army had stormed into East Prussia Russian troops kept up steady pressure against the Hungarians At last on January 20 Hungary Germany's last ally had to sign an armistice

The Russians continued to advance all

along the line from East Prussia to Hungary where fanatical German forces still kept up the struggle One after another Germany s strongholds in the east were overcome By the beginning of April the Russians had reached the mouth of the Oder River they had advanced far into Silesia they had driven across western Hungary and they stood at the Austrian border

In the month of April Germany was crushed by repeated hammer blows from the east west and south The Russians invaded Austria and captured Vienna on April 13 A week later they fought their way into the heart of Berl n gradually overcoming the stubborn resistance of the defenders

American tanks reached the Elbe River only seventy miles from Berlin on April 11 The famous Third Army under General Pat ton entered Germany on the 18th cutting Germany in two One big German city after another—Hanover Weimar Leipzig Stutt gart Bremen Munich fell to the Ameri can British and French invaders Germany was cut up into a number of pockets each more or less isolated from the others

The Allies launched an offensive in north ern Italy on April 9 and by the end of the month the Germans in that area were in full retreat They had to abandon Verona Genoa Milan and Venice At this moment of Allied triumph the former Italian dictator Benito Mussolini was captured by Italian guerrillas He was put to death on April 28 in the village of Dongo on beautiful Lake Como Few people mourned this boastful man who had brought disaster to his native land

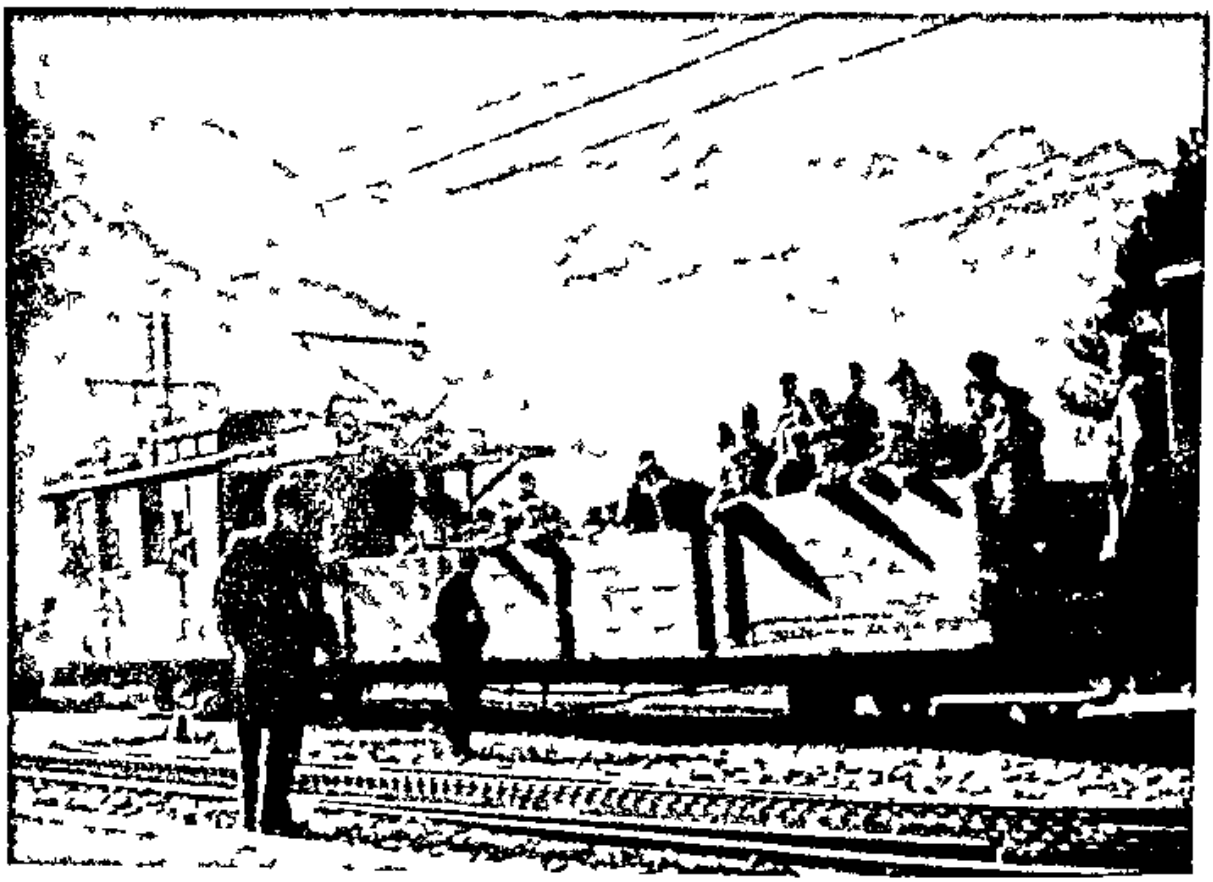
On May 1 the German radio at Hamburg solemnly announced the death of Adolf Hit ler According to this broadcast the German dictator had d ed in h s capital city of Ber lin bravely leading his troops Many people refused to believe this report It was rumored that Hitler had fled—perhaps to Spain per haps to Portugal perhaps to some place of refuge in the Western Hemisphere It really did not matter because the end was now at hand

Berlin fell to the Russians at last on May 2 On the same day the German armies in northern Italy and southern Austria—a total of a million men—gave up the fight Two days later the British accepted the surrender of the German troops in northwestern Ger many Denmark Helgoland and the Frisian Islands Finally on May 8 Admiral Doenitz who had succeeded Hitler signed the terms of definite surrender officially end ng resist ance throughout Germany V E Day—the



Canadian Army Overseas photo

With this surrender at Wageningen, Holland the Germans in western Holland capitulated to the Canadians



Swiss Federal Railroads

With the coming of peace some 300 000 of the U S armed forces were given an opportunity to enjoy the magnificent Swiss Alps. These GI s are taking their climbing the easy way from Zermatt to the Gornergrat.

day of victory in Europe—had come at last

The European continent had suffered terribly from six years of war The countries that had been occupied by Germany and her allies had had a bitter taste of the New Order The Nazis had slaughtered great numbers of innocent people Millions of men and women had been dragged from their homes and had been forced to work as slaves in Germany s war industries The Germans had looted the occupied countries they had left inflation and want behind them

The Axis countries had not escaped the horrors of war Years of relentless bombing by British and American planes had left their mark so had the Allied invasions in the east and west Large areas of Berlin Hamburg Cologne Essen and other German cities lay in ruins Italy Hungary Bulgaria and Finland also bore the marks of Allied air raids and artillery fire The industries and transportation systems of all the Axis countries had been hard hit

There was great political confusion too, in Europe as the war came to an end The Allies had not adopted a uniform policy that would apply in all the countries freed from the Nazis Great Britain and the United States had agreed that the territory occupied by their troops should first be ruled by a British American military body called the Allied Military Government (AMG) As soon as possible the civil administration was to be turned over to a provisional national government in each country

Russia was not represented on the AMG she introduced her own policy in the territories conquered by her armies To be sure in some of the countries occupied by Allied troops there were Allied Control Commissions on which all the principal allies were represented But it was a common complaint that these commissions did everything but control

Governments favorable to the Russians were set up in Finland Bulgaria Rumania and Hungary—all former partners of Germany—as well as in Poland Czechoslovakia and Yugoslavia which had been conquered by the Nazis Some of these governments were dominated by Communists who did not represent a majority of the population

Even before the coming of V E Day, disagreements had arisen between Russia and

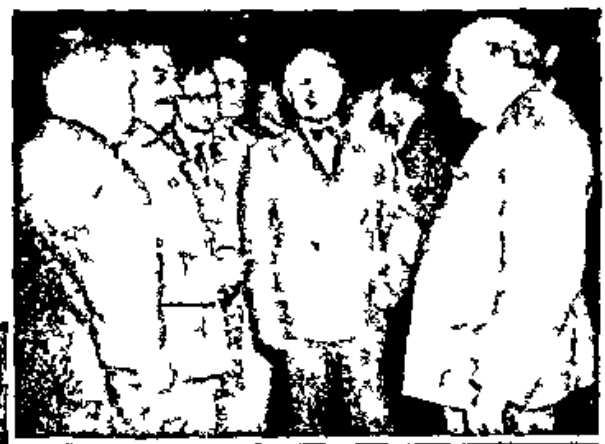
her allies over these governments Russia s allies complained that she had disregarded the rights of the Polish and Yugoslav gov ernments-in exile which had directed the fight against the Axis from London They protested against Russia s policy of prevent ing her allies from finding out what was going on in the countries that had been oc cupied by Red Army troops

For her part Russia pointed out that all had not gone well in some of the countries occupied by Great Britain and the United States In Italy the occupation authorities refused to let the Italians set up a republic British troops had been employed to put down revolts in Greece and Belgium The Russians complained that people s move- ments in these countries had been crushed and that her allies had favored conservative groups

Several months before the end of the war in Europe, President Roosevelt of the United States Prime Minister Churchill of Great Britain and Premier Stalin of Russia met near Yalta in Russia s Crimean Peninsula Among other things they discussed the grow ing misunderstandings between Russia and her allies In a statement issued on February 12, 1945 the three leaders announced that they had agreed to adopt a unified policy in dealing with Germany her partners and the peoples liberated from the Nazis

They discussed rather vaguely the trouble some matter of Allied control in the coun tries that had already been occupied But they set forth in considerable detail their plan for the administration of Germany after her surrender The country was to be divided up into several zones or districts and these would be occupied by the principal Allied powers The Allies would break up the Ger man general staff abolish the Nazi party punish war criminals and remove or destroy all industrial equipment that could be used for war production

The results of the Crimea Conference en couraged the Allied peoples for it seemed to show that the Allies had come to an agree ment at last V E Day came the war in Eu rope was over But the day of victory was darkened by continuing quarrels between the Allies Great Britain and the United States were still not satisfied with developments in Rumania, Bulgaria Hungary and Yugo





Signal Corps photos

The Big Three at Potsdam Germany Above: Stalin Truman and Churchill smile in friendly fashion Below Truman's back is turned toward the camera. *Churchill and his aides are at the left Stalin is seated at the right.*



B t sh Informa on Serv ces

Prime Minister Attlee announces Japan s surrender

slavia which the Russians dominated Russia objected to the Allied policy in Italy and Greece

On July 17 President Truman, Premier Stalin and Prime Minister Churchill met at Potsdam near Berlin and began a new series of conferences Churchill was replaced on July 28 by the new British prime minister Clement R Attlee On August 2 Truman Stalin and Attlee issued a joint statement, which was called the Potsdam Declaration

The declaration outlined a general policy for the handling of the German problem following pretty closely the plan already presented at the Crimea Conference It dealt in far less detail with the other occupied countries It expressed the pious hope that Allied newspaper men would be permitted to see what was happening in Rumania Hungary, Bulgaria and Finland

Misunderstandings between Russia and her allies continued Some statesmen thought that this was because no official peace treaties had as yet been signed Therefore on September 11 1945 a Council of Foreign Ministers representing the United States Great Britain Russia France and China met at London in order to draw up preliminary peace terms The Council of Foreign Ministers accomplished nothing practical Indeed it appeared to have caused bitterness among the Allies

Another effort was made to bring them together in December 1945 when Secretary of State Byrnes of the United States, Foreign Minister Molotoff of Russia and Foreign Secretary Bevin of Great Britain met in Moscow At this conference it was agreed that the Big Three—the United States. Great Britain and Russia—would draw up peace treaties with Italy Rumania Bulgaria Hungary and Finland They would then submit these treaties to a peace conference that would include all the powers that had fought on the Allied side The Moscow meeting represented a step forward Yet at the year 1945 drew to its close there was still no unified policy for the settlement of Europe s problems

IN MANY COUNTRIES THERE WERE IMPORTANT POLITICAL CHANGES

Yet the countries of Europe did not mark time in 1945 or patiently wait for the Allies to become truly allied There were important political developments in almost every one of these countries Let us briefly survey these developments

Few nations suffered more in the war than Russia none came out of it with greater prestige The soviet system of government had triumphantly stood the test of war Despite the destruction caused by the nazi invasion, the Russian people faced the future with confidence They were enthusiastic about a new five-year plan for 1946-1950—a plan intended to create a greater industrial Soviet Union than existed before the war

THE LABOUR PARTY CAME INTO POWER IN GREAT BRITAIN

Great Britain underwent a major political change in 1945 On July 5 the country held its first general election since 1935 The British voters went to the polls on that day to select the members of a new Parliament The Labour party won an overwhelming victory in the elections obtaining a majority of the seats in Parliament Prime Minister Churchill who had been in office since May 1940 resigned and was replaced by Clement R Attlee Churchill was returned to Parliament in the election He announced that he intended to remain in that body as a leader of the Opposition to the Government

The new government announced plans to nationalize (set up government ownership over) certain industries which are of vital importance to the country as a whole These include the iron steel coal and electric industries The Bank of England was also to

be nationalized Other industries were to be permitted to go on under private ownership

The nationalization program proceeded slowly in 1945 A bill to nationalize the Bank of England passed the House of Commons in October, but the bank was still in the hands of its owners at the end of the year. There were various reasons for the Labour Government's slowness in pushing the socialization of Great Britain For one thing the country was exhausted after six years of total war, and it was feared that too rapid socialization might bring about a crisis

Then, too, the British faced many difficulties abroad There was trouble with India, which sought immediate independence, and in Palestine, where Jews and Arabs were in conflict British troops were called on to intervene in the Netherlands East Indies, French Indo-China, Syria and Lebanon (See Asia) In general the Labour Government carried on the policy of the conservative governments of the past—that is, it upheld the interests of the British Empire throughout the world

France, which had surrendered to Germany in June, 1940, went far in 1945 to recover her former position as one of Europe's foremost countries General Charles de Gaulle, who had never given up the fight against the Axis, had helped to set up a Provisional French Government on August 15 1944 Under De Gaulle s inspiring leadership this government sought to bring about unity among Frenchmen It enjoyed wide support yet some Frenchmen criticized it because it had not been put in office by the vote of the people

On October 21, 1945, the voters of France had their day at last They voted overwhelmingly to create a National Constituent Assembly, which would draw up a new constitution The three most important groups in the Assembly were the Communists, who formed the largest single group the Socialists and the Popular Republican Movement a new party made up of liberal Catholics These three groups formed a coalition which won control over the Assembly

The Assembly unanimously elected General de Gaulle president of a provisional government that was to serve for a period of seven months During this time a new constitution would be drawn up The nation would then go to the polls again in order to



The royal family greets the crowds that gathered to welcome King Haakon VII on his return to Norway on June 7 Left to right: Princess Astrid Crown Princess Martha Prince Harald, Princess Ragnhild Crown Prince Olav

accept or reject the constitution

The French took steps in 1945 to punish those of their leaders who had worked with the enemy Marshal Henri Philippe Petain head of the Vichy French Government which had been set up after France's surrender was sentenced to death for treason (intelligence with the enemy) on August 15 In view of his age the sentence was commuted to life imprisonment Pierre Laval former premier of the Vichy Government also received the death penalty and he was shot on October 15 A number of other disloyal Frenchmen were sentenced to death or were condemned to long terms of imprisonment

GOVERNMENTS IN EXILE AND WHAT BECAME OF THEM

Some of the occupied countries went back to the old governments of the days before the war King Haakon VII of Norway Queen Wilhelmina of the Netherlands and Grand Duchess Charlotte of Luxemburg had established governments in-exile they were welcomed back by their peoples The Czechoslovak Government in Exile headed by Eduard Benes also returned to power King Christian X of Denmark had remained in his native land during the nazi occupation But he had not collaborated with the Nazis and the Danes were glad to acknowledge him as their king when the Germans were driven out

The situation was different in the other occupied countries As the year 1945 opened the Polish Government in Exile found itself barred from its native land much of which had been recaptured from the Germans by the Russians The Government in Exile which had its headquarters in London was backed by Great Britain and the United States The Russians supported a provisional government which had been set up at Lublin The Big Three agreed at the Crimea Conference of February 1945 to try to bring the two opposing groups together

A NEW GOVERNMENT FOR POLAND WAS RECOGNIZED IN JULY

On June 23 a new Polish government was formed with Edward B Osubka Morawski as premier It consisted mainly of members of the Lublin group though the Government in Exile was also represented The new government was recognized on July 5 by Great Britain and the United States and it has been in power ever since It has never been accepted by some members of the former government in-exile who claim that the country's leaders are trying to set up a communist government on the Russian model

In Yugoslavia too a government backed by Russia won the day over a government in exile A communist guerrilla leader Tito, whose real name is Joseph Broz had won control over part of Yugoslavia even in the days when the Germans occupied the land He refused to have anything to do with the Government in Exile which acknowledged young King Peter II as its lawful sovereign Tito a friend of Russia strengthened his rule when the Russians occupied the country

On November 11 1945 elections were held for representatives to a National Assembly of two houses Tito's enemies claimed that he was determined to set up a communistic form of government—a totalitar

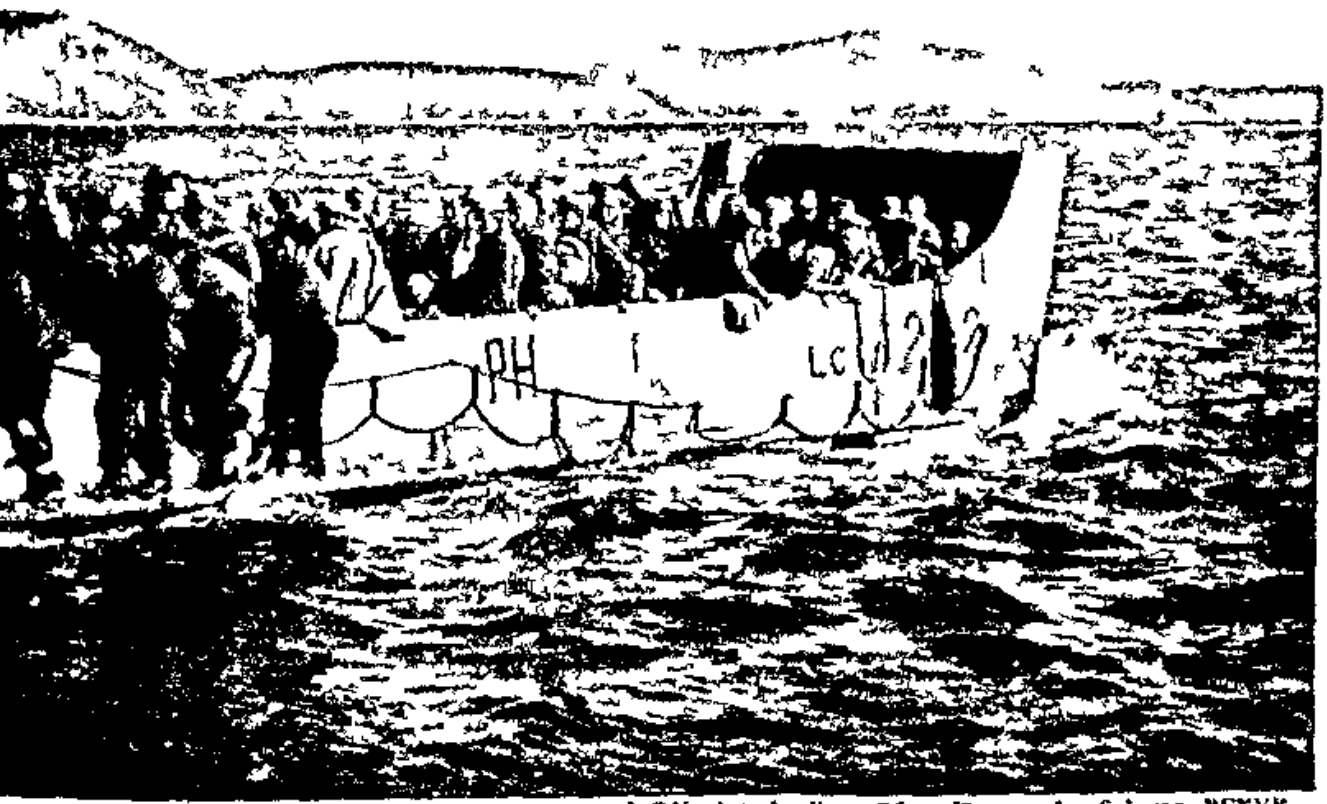
Canadians helped bring Greek army men to safety

ian or as they put it a Titotalitarian gov ernment They feared that the elections would not be fair and therefore they an nounced that they would stay away from the polls Naturally Tito s candidates won and and thereafter his power was supreme On November 29 the two houses of the As sembly approved a proclamation by Tito abolishing the monarchy and sett ng up a republ c King Peter s last hope of regaining his throne vanished when the United States State Department announced that America would recogn ze Tito s gov ernment

The Belgian Government in Exile returned to its native land on September 8 1944 King Leopold recognized by this govern ment was a prisoner of the Naz s and of course would not be available until after the war Therefore the Belgian Parl ament chose Prince Charles Leopold s younger brother as regent to act in Leopold s place

Premier Hubert Pierlot of the Govern ment in Exile was very unpopular and he was forced to resign on February 7 1945 He was succeeded by a Socialist Achille van Acker Van Acker like many other Belg ans held that King Leopold had betrayed h s country when he surrendered the Belgian army to the Germans on May 28 1940 Van Acker declared that the country would never be willing to have the King return to the throne

Leopold was freed from the Germans in the early days of May 1945 He delayed h s return to Belgium but announced that he still considered h mself to be the country s rightful ruler Public op n on was against him On July 17 1945 the Belgian Chamber of Deputies barred the King from returning to the throne without Parl ament s permis



R.C.N. photo by Petty Officer Photographer Sul van RCNVR

A landing craft from the Canadian warship H.M.C.S. Prince Henry active in the desperate civil war in Greece.


RIE



French Press and Information Service

An elderly French woman casting her first vote The women of France won the suffrage in 1945

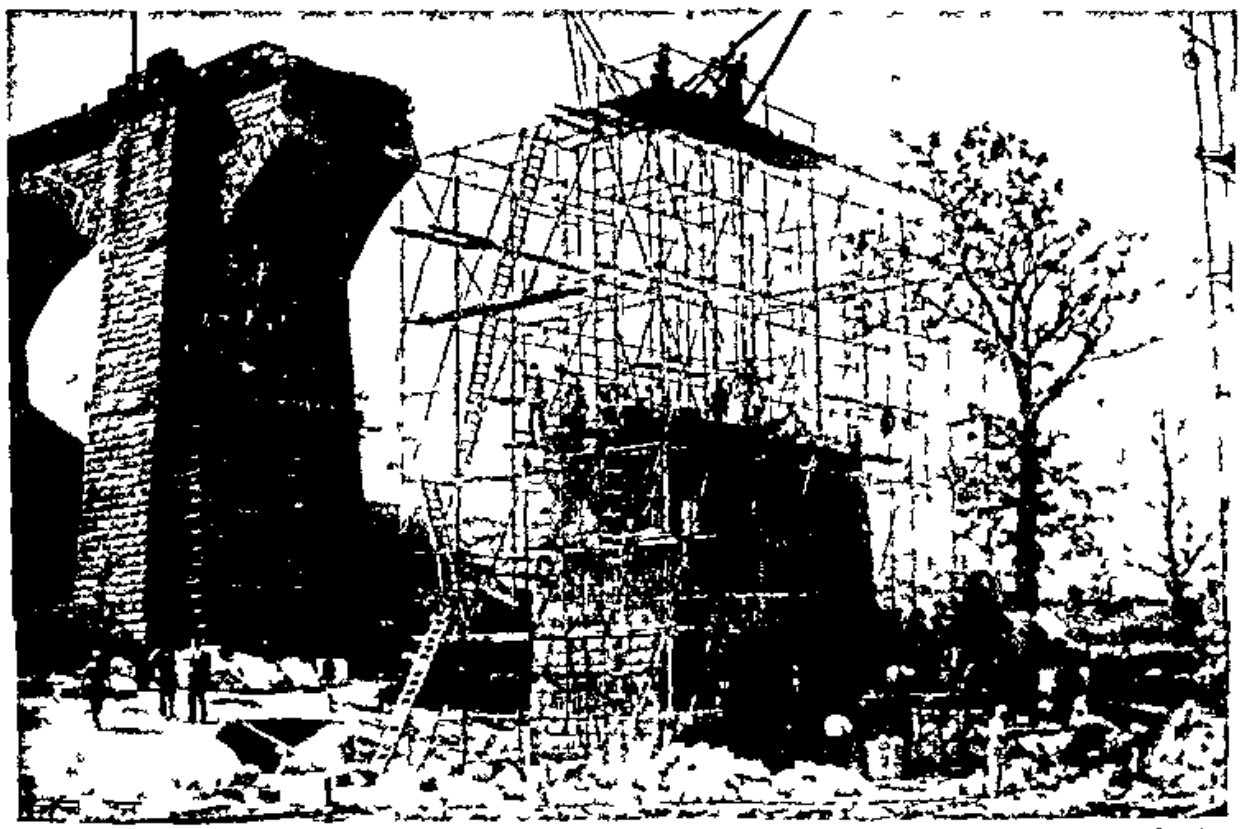
sion Prince Charles is continuing to serve as regent

The Greek Government-in Exile returned to power in Greece in November, 1944, when the British occupied the country King George II, however, agreed not to come back to Greece until his people had had a chance to vote on the question of keeping the monarchy In December, 1944, fighting broke out between the Government and the radical ELAS group The British arranged for a truce, and a compromise government was set up with Archbishop Damaskinos as regent

Unrest continued throughout 1945 The country had suffered terribly in the war, and conditions improved but little with the coming of peace One premier after another gave up the attempt to form a stable government The regent himself was so disheartened that he resigned in November but he was persuaded to remain in office

Little Albania which was swallowed up by fascist Italy in April, 1939, has become a republic The United States, Great Britain and Russia agreed to recognize the Government on condition that elections for a Constituent Assembly should be 'on a free basis" In the elections, held on December 2 1945, the Democratic Front party of Premier Enver Hoxha won all eighty-two seats in the Assembly Hoxha is a national hero He was a leader of the Albanian underground when the country was under the rule of Italy

Of all the European nations that fought on the Axis side, none was held to be more



French Press and Information Service

After war—work! Here we see workmen rebuilding a war ruined viaduct near the city of Nantes in France

guilty than Germany which had started the war in September, 1939 and which had been guilty of unspeakable crimes against humanity The Allies were prepared to occupy the country for years if necessary to make sure that nazism would be destroyed and that Germany would never again be able to threaten the peace of the world

In accordance with the plan suggested at the Crimea Conference Germany was occupied by the United States Great Britain Russia and France each taking over a definite zone The commanders of the four zones served as members of the Allied Control Council which had its headquarters in Berlin All problems concerning Berlin and the country as a whole were dealt with by the Council a unanimous vote of the four members was required for every decision

The zone system did not work very smoothly Each zone became more or less isolated from the others and this made it difficult for the occupation authorities to set up efficient control over the country as a whole There was no generally accepted plan for operating the transportation postal and crop-control systems In a report made public on November 28 Byron Price a special investigator for President Truman reported that conditions had become increasingly bad because of the lack of a unified system of administration

THE PUNISHMENT OF NAZI WAR CRIMINALS

Yet in spite of the difficulties involved in the occupation of Germany the Allies made definite progress in carrying out the provisions of the Crimea and Potsdam conferences Various steps were taken to punish the nazi war criminals A few of them took their own lives rather than await trial for their crimes Among these were Paul Joseph Goebbels the chief propagandist of the Nazis Heinrich Himmler the chief of the *Gestapo*, or secret police and Robert Ley the head of the German Labor Front It is commonly believed that the arch criminal Adolf Hitler, also committed suicide

PLOTTING AGAINST WORLD PEACE IS THE GREATEST OF ALL CRIMES

Other leading war criminals—twenty four in all—were indicted by the International War Crimes Tribunal and twenty of them were brought to trial at Nuremberg on November 20 1945 They included Hermann Goering second only to Hitler in the Nazi party, Rudolf Hess, deputy Nazi party leader until 1941 Joachim von Ribbentrop foreign minister Field Marshal Wilhelm Keitel chief of the German high command Grand Admiral Karl Doenitz commander of the Navy and Alfred Rosenberg the so-called thinker of the Nazi party The defendants were accused of a wide variety of crimes from plotting against the peace of the world to the killing of helpless prisoners of war

The trial had not been completed by the end of 1945 and it seemed likely that it might last for months In the meantime a number of lesser German war criminals had been tried before military courts and had paid the penalty for their crimes They included members of the German armed forces and civilians who had been guilty of crimes against Allied soldiers they also included a number of commandants and guards who had served in the infamous concentration camps

THE QUESTION OF GERMAN ASSETS AND WHAT GERMANY SHOULD PAY

Progress was made in the matter of obtaining reparations from the Germans The Potsdam Declaration of August 1945 had revealed that Russia and Poland were to receive reparations from the zone occupied by Russian troops The United States Great Britain and other countries were to take over German assets in the western zones of Germany Russia would also receive a certain amount of reparations from these zones Representatives of eighteen nations meeting at Paris in a conference that lasted from November 9 to December 1 agreed on the way in which the German assets in the western zones should be divided

The tearing down of Germany's war industry went on at a steady pace Many factories which had manufactured guns ammunition tanks and planes were blown up or were stripped of their equipment However the question of just how much industry will be left to Germany has not been decided because the Allies have not been able to agree on this troublesome matter

CAN GERMANY LEARN TO UNDERSTAND THE MEANING OF DEMOCRACY?

The Nazi party has disappeared though some people think that it has only been driven underground The Allies hope by re-educating the German people to prevent the Nazis from ever returning to power The occupation authorities have removed many nazi teachers from positions of trust and in

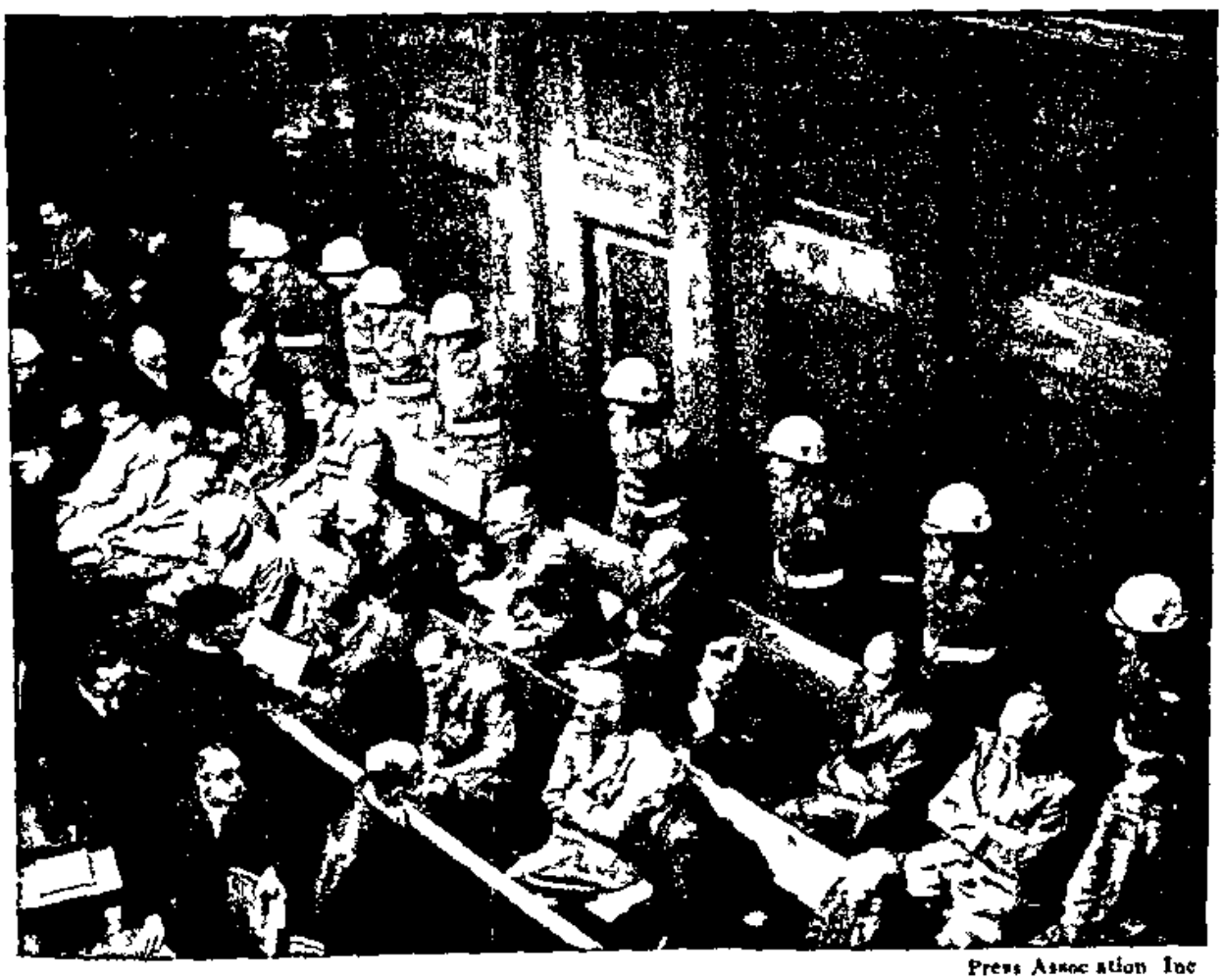
fluence and have replaced them with teachers of known democratic sympathies They have also banned the use of the textbooks which glorified the Nazis and their exploits The re education of the German people will probably be a slow affair Observers agree that most Germans have no sense of national guilt they regret only having lost the war

Austria annexed by the Germans in March 1938 has now won her freedom When the Russians occupied Austria in April 1945 they backed a new Austrian republic set up by a combination of Communists Social Democrats and Christian Socialists and headed by a Socialist Dr Karl Renner At first Great Britain and the United States refused to recognize this republic declaring that it was not truly representative

In August 1945 the Allies agreed to set up a four zone occupation system in Austria the occupying powers being the United States, Great Britain Russia and France The Allied Council for Austria recognized the Renner Government two months later It was destined to remain in power for only one more month for it suffered a disastrous defeat in the November 25 elections for a National Assembly The conservative Catholic People s party won eighty four seats the Socialists seventy six The Communists who had played an important part in the Renner Government obtained only five seats On December 4 Leopold Figl head of the Catholic People s party took over the post of chancellor (chief minister of state) replacing Renner

The small republic of Finland which fought Russia twice in World War II and twice had to sue for peace has sought to cooperate with its powerful Russian neighbor particularly since the liberal government of Premier Paasikivi came into power in April 1945

Hungary which had joined the Axis in November 1940 underwent several political upheavals in 1945 After the Russians forced the Hungarians to sign an armistice



Press Association Inc

Nazi leaders on trial Nuremberg Germany This trial sought to establish aggressive warfare as a crime



Brı sh Inform a on Serv ces

Food from England on its way to hungry Europeans.

in January 1945 a rad cal government was set up in which Communists were very powerful But this government was over thrown as a result of the elections of No vember 5 1945 when the conservative Small Holders party won a majority of the seats in Parliament The United States and Great Britain have recognized the govern ments of Finland and Hungary because the people of these countries have had a chance to make their wishes felt in free elections

Bulgaria and Rumania had not won rec ognition by either the Americans or the Brit ish as 1945 came to an end In both coun tries radical governments had been set up

Italy which was the first fascist state and the chief partner of Germany in the Axis has fallen on evil days She lost her African empire in the war and it is not certain that she will recover any of it The country was laid waste in the course of almost two years of desperate fighting between the Allies and the Germans following the Italian surrender Today there is widespread misery and want among the people Mussol ni, who brought Italy into the war on the side of the Axis was chiefly to blame perhaps for the coun try s plight Many Italians however con demn with equal bitterness the royal house of Savoy

Yet curiously enough the house of Savoy still rules Victor Emmanuel III who came to the throne in 1900 still bears the title of King of Italy but he has turned over the royal powers to his son Crown Prince Hum bert whose official title is Lieutenant Gen eral of the Realm Italian liberals blame Great Britain for this situation Some day perhaps the Italians will be allowed to de cide for themselves what kind of govern ment they want

And what of the neutral countries? As we have seen Switzerland and Sweden were democratic countries which were forced to remain neutral because of their geographical position The neutral ty of fascist Spain was chiefly due perhaps to the fact that the civil war of 1936 1939 had left her ex hausted Certainly the Spanish dictator Gen eral Francisco Franco made no secret of his sympathy with the Axis powers in the early days of the war

HOW FRANCO TRIED TO WIN THE APPROVAL OF THE UNITED NATIONS

As the Allies gained the upper hand how ever Franco tried to win favor with the United Nations He freed hundreds of American and British flyers who had been forced to land on Spanish soil and who had been interned He forbade the export of war materials to Germany He recalled a number of Spanish volunteers who had fought on the side of the Germans

Franco also sought to appease the All es by making his government more liberal On October 22 he took what he seemed to th nk was a decisive step in this d rection He issued a decree giving the Spanish people a bill of rights It was indeed a curious docu ment it permitted Spaniards to do almost anything they wanted provided the dictator approved of what they did!

The Allies were not much impressed by Franco s efforts to win their good will The Franco Government was denounced again and again by responsible authorities in the United States Great Britain Russ a and France And yet Franco continued to rule The chief reason was that the All es could not agree on a common policy toward Spa n The United States and Great Britain agreed with Russia and France that the Franco Government was bad But they feared that an open break with Franco might strengthen his hold on some of his wavering supporters who would resent foreign interference

Portugal like Spain is a fascist country Yet for hundreds of years it has been bound by ties of friendship with Great Britain It certainly helped the British and the other Allied countries greatly in the never ending fight against the German submarines by granting the British a naval base in the Azores It is probable that Portugal took this step as a result of Allied pressure At any rate the country remained neutral throughout the war It carried its neutrality so far as to decree public mourning for the death of Adolf Hitler

Eire has occupied a rather curious position for a number of years It is bound by certain ties to the British Commonwealth of Nations Yet it is no dominion like Canada or Australia but a sovereign independent state It conducted itself like a sovereign independent state during the war remaining strictly neutral

THE PUZZLING ANNOUNCEMENT MADE BY EAMON DE VALERA

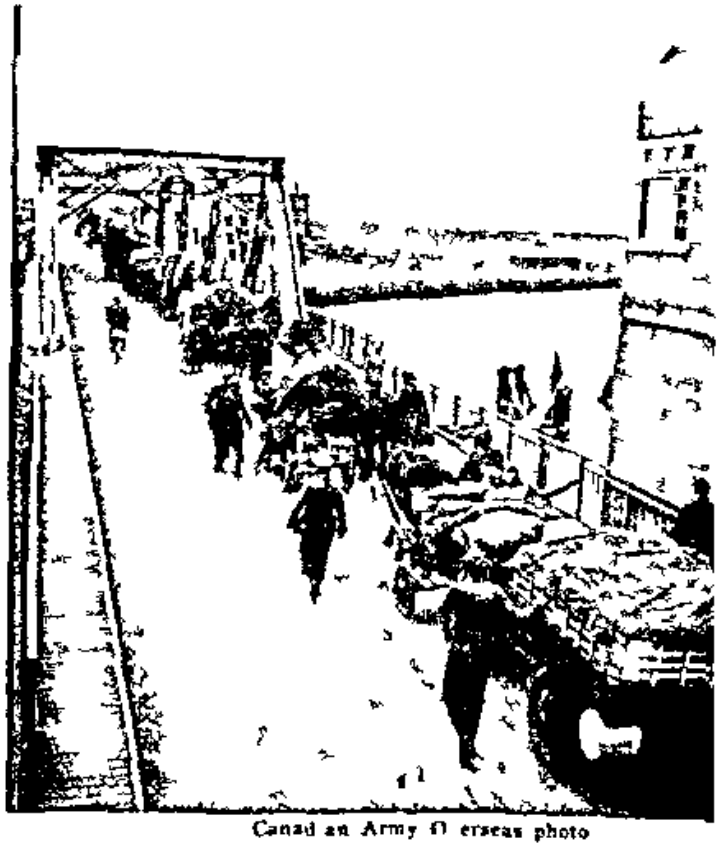
On July 11 1945 Prime Minister Eamon de Valera caused a stir in the Eire Parliament when he declared that Eire was a republic Several days later he explained that his country had become a republic on December 29 1937 when its new constitution went into effect Did this mean that from now on Eire meant to throw off all ties with Great Britain? Not at all! Eire de Valera went on to say is still associated as a matter of external policy with the British Commonwealth of Nations

The political developments that we have been discussing are of great importance for upon them will depend the future of the European continent Yet there are other problems which are even more vital to millions of people A particularly pressing one is that of providing relief—food clothing and housing—for the needy of many lands In 1945 the chief burden of supplying relief fell upon the United Nations Relief and Rehabilitation Administration (UNRRA) A number of members of the United Nations are taking part in the UNRRA program

Another problem is that of providing for displaced persons that is refugees driven from their homes and unable to return One estimate that of Britain's Royal Institute of Foreign Affairs sets the number of displaced persons in Europe at twenty million Among them are millions of Germans who were forced to leave Poland Czechoslovakia, Silesia East Prussia and the eastern part of Pomerania The displaced persons also include Jewish victims of the Nazis and great numbers of Russians Poles Belgians French Czechoslovaks and Yugoslavs who were brought into Germany to toil like slaves in the fields or in war industries The task of caring for these people and restoring them to a useful life will be one to tax the resources of the UNRRA and other agencies

The story of Europe in 1945 is not a pleasant one The continent has been freed from the nazi yoke but the most terrible war in the history of mankind has left behind it unspeakable misery Moreover quarrels among the victors have aroused fears that the Allies may lose the peace after having won the war at frightful cost

The chief hope of the future lies in the United Nations Organization (UNO) the new league of nations to which many of the countries of Europe belong (See the United Nations) In 1945 the UNO existed only on paper the first meeting of its Assembly was not scheduled to take place until January 10 1946 Will it continue to be a paper organization in the years that lie ahead? The future happiness and prosperity of Europe and indeed of the whole world, will depend upon the ability of men of good will to make the UNO really work



Canadian Army Overseas photo

Back where they came from! Germans leaving Holland.

FORCE WORK POWER ENERGY











By

Simon Weissman

HAVE you ever heard your friend strike a wrong note on the piano when playing a very familiar piece? Either you laughed or became annoyed Good musicians do not make such mistakes

Have you ever heard people use words that do not belong? Surely you noticed that too! Once more either you laughed or became annoyed Your English teacher insists that you use words correctly Scientists are more much more, exacting in their use of words For instance, the words force work power and energy are often misused by ordinary people because their meaning is not really understood In science each of these words has a separate and distinct meaning and can not be interchanged with the others

The word "force appears very often in the study of physics There are many kinds of forces The gravitational pull between the earth and your body when you are standing on a scale is a force We drop a ball and it falls by the force of gravity A mountain stream rushes to the sea by the same force of gravity Our own muscular pulls and pushes are forces The force created by an explosion of powder in a cartridge causes a lead bullet to move at high speed, when the bullet strikes a steel plate a force is produced which not only stops the motion but also changes the shape of the bullet *Force is anything that tends to produce motion in a body or changes of motion in that body*

When a brick is attached to a spring scale you will notice that the spring scale stretches a certain amount When two bricks are attached the spring will stretch twice the amount and three bricks will stretch the spring three times as much Thus we can see that the gravitational attraction of the earth for the brick which is a force can be measured by measuring the amount of stretching which the force produces in a coiled spring Suppose that each of the bricks weighs two pounds Attach a string to one of them What would be the tension or the pull, in the string? The answer is obviously two pounds To prove this insert a spring scale any place between the brick and the string the spring scale will read two pounds Thus we see that the gravitational pull on the brick is a force that can be measured by means of a spring scale

From this little experiment we also learn that tension is a force, too We have mentioned before that muscular pushes are also forces If you take a coiled spring between your hands and compress it you will note that its size decreases To do this requires a force just as in the case before when we stretched the string The two-pound brick will compress the spring when placed on top of it just as much as it will elongate (lengthen) *the spring when suspended from it* In

train against frictional resistance The columns in a modern steel building do no work although they sustain great weight, if they did work there would have to be motion and if the building were moved it would probably collapse If you hold a chair in your hand you may get tired but you will do no work in the sense in which this word is used in physics All that counts in physics is the result and not the effort made The important thing to remember is that a force must move through a certain distance in order to produce work

THE TERM POWER TAKES THE ELEMENT OF TIME INTO CONSIDERATION

Suppose a man can carry a ton of bricks to the roof of a building in ten hours and that a steam shovel can accomplish the same work in one hour In each case the same amount of work is done *Time* does not enter into the calculation of the *amount* of work done Power is a term which takes into account the time element or the rate at which work is done The less time it takes to do a certain amount of work the more power is exerted If it takes the steam shovel less time to lift the bricks to the top of the building it is because the steam engine has more power Time is an important element in comparing the work of a man and the work of an engine Such a comparison is made by dividing the work by the time In our example the steam engine is ten times as powerful as the man because it does the same amount of work in one tenth of the time *Power is work divided by time*

THE ABILITY OR CAPACITY FOR DOING WORK IS WHAT WE KNOW AS ENERGY

From our everyday experiences we know that under certain conditions bodies possess the capacity for doing work Thus a coiled up spring a body of water at a high level and steam confined in a steam boiler are all able to do work if we connect them to the proper motors The mechanical energy stored in the main spring of a clock does work on the gears of the clock When the body of water at high level is allowed to fall it can turn the water wheel of a flour mill This water wheel in turn is connected to the proper grinders to grind the flour and when the flour has been ground work has been done A steam boiler may be used to drive a steam engine such as we have mentioned before, in lifting the bricks to the top floor of the building Surely work was done in that case From the examples we have just mentioned we can conclude that *energy is the capacity for doing work*

A body may be capable of doing work immediately due to the fact that it is in motion (a torpedo heading for a ship) or it may be capable of doing work at some future time (the wound up mainspring of a clock) The energy that has been stored in the clock spring is called *potential energy* The body of water at high level and the steam in a boiler are also examples of potential energy Every body which is in motion possesses *kinetic energy* (Kinetic comes from the Greek word for motion) The swiftly moving torpedo which demolishes a ship the descending hammer which forces a nail into wood the rapidly moving rivers which carry bridges away are only a few examples to show that kinetic energy can do work

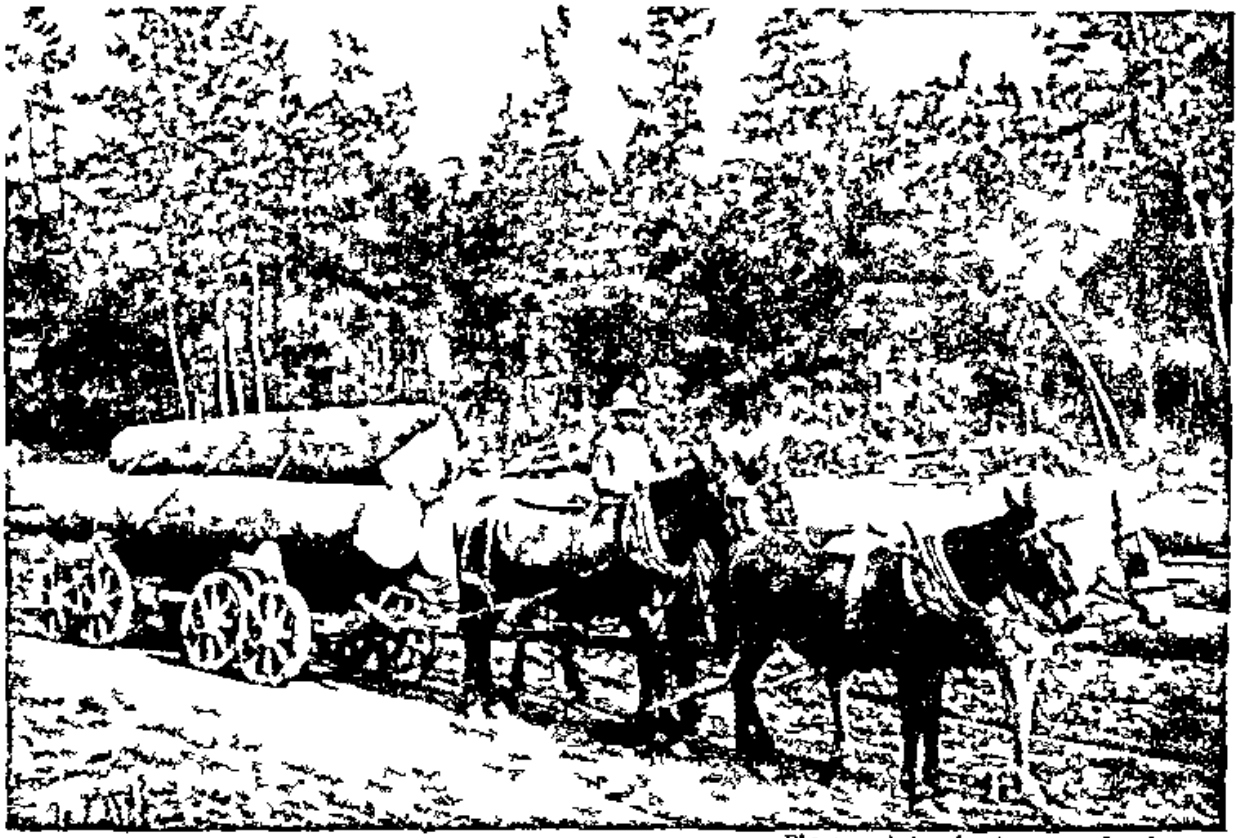
POTENTIAL ENERGY IS STORED ENERGY; IT IS A CAPACITY FOR FUTURE WORK

You may know that some clocks are operated by falling weights When these weights are lifted potential energy is stored in them Since the force of gravity acts on them all the time they descend slowly and operate the clock Here we see an example of how potential energy of the lifted weight is slowly being converted into kinetic energy of the falling weight Another example may make this clearer You know what a pile driver is —a huge weight that is lifted by machinery some feet above the ground and then allowed to fall upon a pile (a post) that is to be driven into the earth When the pile driver is lifted work is done on it Potential energy is stored in it From our discussion before we know that this pile driver is now capable of doing work This is precisely what we mean by energy—ability to do work When the pile driver is released and allowed to descend it can do work by driving a post into the ground Thus we see that the potential energy of the pile driver when it is in the air is converted into kinetic energy when it moves and so it does work

WE SHOULD LEARN TO USE THESE TERMS OF SCIENCE IN THEIR EXACT MEANINGS

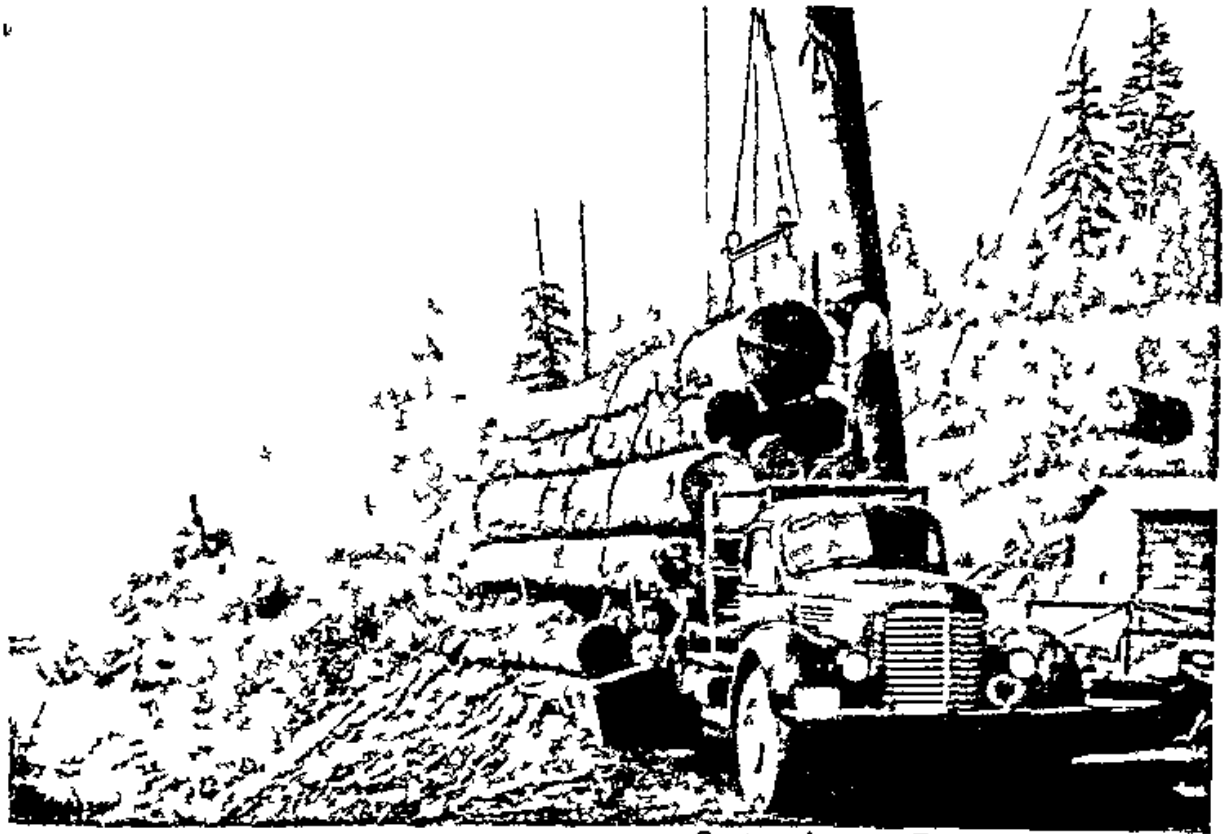
In closing let us review what we have learned Force is a push or a pull which tends to change the motion or shape of a body When this force is applied to move a body a given distance the work done is equal to the force times the distance Power is the rate of doing work that is the work done divided by the time it takes to do it Energy is the capacity for doing work.

WORK AND ENERGY IN A LUMBER CAMP



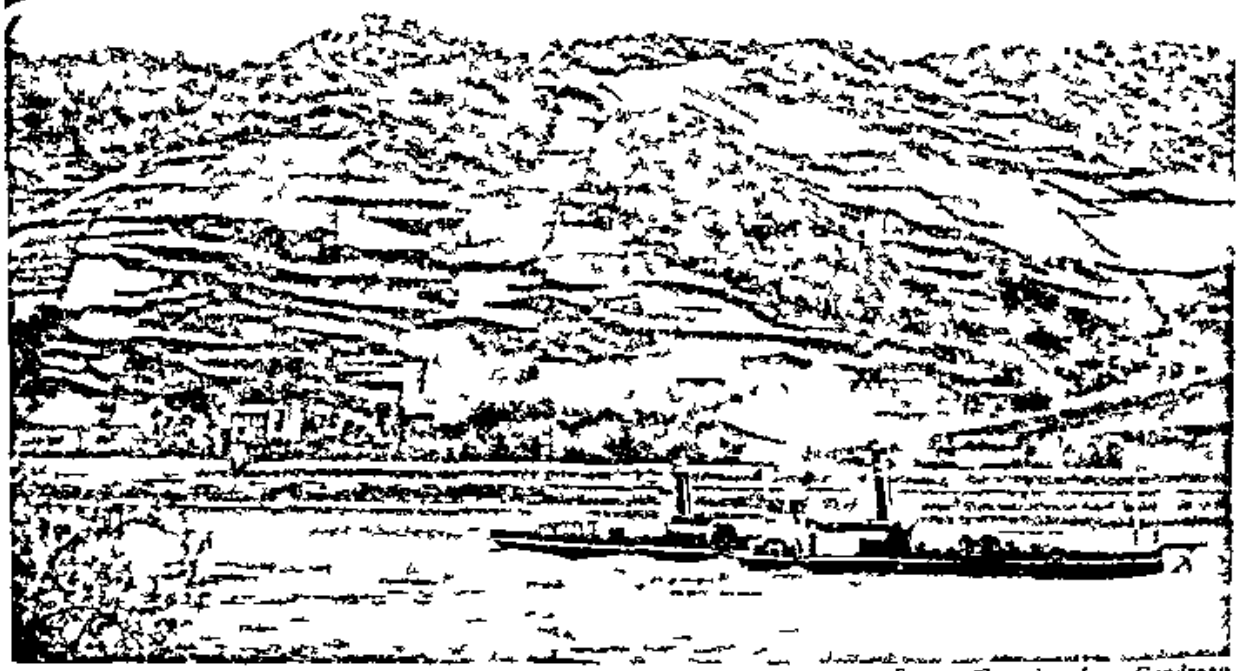
Photograph by the American Lumberman

The mules pulling the logs are doing work by moving the load. The work is equal to the force times the distance.



Courtesy American Trucking Associations, Inc.

If these logs are released, they will roll down the hillside. In the position shown they have potential energy.



Screen Traveler from Gendreau

Terraced vineyards climb the steep hillsides that line the storied Rhine River along a part of its course

GERMANY

By George N Shuster

President Hunter College

HAD you visited Germany before the war, you would probably have gone by boat to either Hamburg or Bremen These are old cities on the Elbe and Weser rivers, which empty into the same section of the North Sea Then you would probably have taken a fast train to Berlin, the nation's capital, across very flat country The stay in Berlin might have seemed uninteresting had it not been for walks down Unter den Linden, Berlin s wide thoroughfare of shops and government buildings, which leads from the Brandenburg Gate to the palace of the former Prussian kings, and for trips to the city s famous museums and theaters

After Berlin, you might have visited some picturesque towns along the seacoast Like Bremen and Hamburg, these once belonged to the Hanseatic League of free cities, so called because of the Hansa, or guild of merchants, which as early as seven hundred years ago built up a prosperous foreign trade The timbered houses, quaint town halls, fashioned of dull red brick, and beautiful churches of these towns testify to their wealth and culture in those olden times Lubeck, where the novelist Thomas Mann was born, Rostock and Danzig are the most interesting of the old cities Still another historic town is Elbing where a colony of English merchants settled in the days of Shakespeare There are still some old seven gabled houses in Elbing

Turning southward, you would soon have discovered that the historic beauty of Germany as well as its modern industrial life were centered in the great river valleys. Farthest west is the Rhine, which countless visitors have enjoyed because of the romantic scenery along its banks The lordly river, together with its tributaries, is also the nerve center of German industry

Cologne, the largest city in this valley, was once an ancient Roman town, from which the Emperor Augustus dispatched his legions to conquer the warlike German tribes, led by Arminius, in the surrounding forests (The Romans failed to conquer these fierce fighters) Until the war against Hitler destroyed so much of it, Cologne had many beautiful buildings, among them churches almost a thousand years old

A sluggish little stream called the Ruhr flows through rich coal fields and empties

into the Rhine north of Cologne Near the point where the two rivers meet there are important manufacturing cities One of them is Essen, *home of the German steel industry* Another is the great inland port of Duisburg Relatively little iron is mined in Germany, so that industry relies on ore imported from France and Sweden and brought up the *Rhine to the manufacturing cities*

Farther east, the Elbe and the Oder rivers cross Germany These broad streams are waterways which for centuries past have carried German produce and manufactured *goods to market Along them many* important cities were built The Rhine the Elbe, the Oder and most of the other rivers of Germany take a general northwesterly course, and empty into the North Sea or the *other great arm of the ocean, the Baltic*

THE "BLUE" DANUBE BEGINS ITS LONG *JOURNEY IN THE HILLS OF WÜRTTEMBERG*

There is at least one great exception, the *Danube with its tributaries which flows* across half the width of Europe taking a southeasterly course The Danube is a small river at its source in the hilly, picturesque region of Wurttemberg, in southern Ger*many*, but later on it becomes a *mighty* stream, the gateway to southeastern Europe It empties into the Black Sea The Danube is flanked over most of its course by mountain ranges, offshoots of the Alps and the Carpathians. Perhaps the best known of these ranges in Germany are the Bavarian Alps Nestled in their valleys are charming old towns where time seemed to stand still—that is, before 1939 One of these towns was Oberammergau, where the Passion Play, relating the story of Christ's life, was performed reverently every tenth year by German *farmers and artisans*

MODERN INDUSTRIES AND OLD *HANDICRAFTS EXIST SIDE BY SIDE*

In modern times, Germany became an industrial *country*, and for generations past the majority of its inhabitants have made a living by working at coal mining, steel production, shipbuilding, and the manufacture of electrical appliances, textiles, machine tools and chemicals These industries flourished partly by reason of the excellence of German training in the sciences. Nevertheless *interest in the handicrafts survived*, and German workmen were probably unexcelled at such trades as the grinding of lenses, color printing and the making of precision instruments Old arts likewise formed a basis for modern enterprise—doll making, for instance But although many people worked at trades as diverse as the manufacture of *Christmas tree ornaments and the carving* of cuckoo clocks, such large numbers were dependent on the mines and the foundries that when these enterprises did not prosper mass unemployment resulted

CAREFUL CONSERVATION OF SOIL IS PRACTICED

The German farmer for his part is more methodical and scientific than the French *peasant Like the French peasant he is* closely attached to the soil and to local custom In some regions the ground he tills is fertile, but in general he must make a living in spite of many difficulties The vineyards *along the Rhine and the Moselle are good* illustrations Here the vines grow on little terraced plots that cover steep hillsides rising from the river valleys Every foot is precious because the grapes ripen best in the *sun as it beats upon the sloping ground But* earth washed down by the rains must be carried up again in baskets and the ravages of winter have to be carefully repaired each spring During many months the soil is tilled and the plants are tended by hand Grape-picking time keeps whole families busy from morning till night gathering the clusters

THE SANDY EASTERN DISTRICTS ARE MADE TO YIELD GOOD HARVESTS

Even more remarkable, perhaps is the German farmer's success in growing on the sandy loam of *the eastern districts large* crops of potatoes, rye and sugar beets Just before the war, Germany's production of all cereal grains (except wheat) was greater than that of any other country except the *United States and Russia Thus Germany* could almost meet its basic food requirements. The German farmer is normally loyal to his religion and his traditions Peasant dress is worn in some regions

The course of life in Germany has been most affected by the geography of the country In the time of the Roman Empire, civ*ilization in Europe did not spread much be*yond a sort of oval, the northern boundary of which ran through Cologne, while the southern boundary passed through North Africa During the early years of the Christian Era, the Romans attempted to complete the conquest of northern Europe, but they failed Then, to protect themselves against invasion, they built a fortified line, the so-called *limes*, which ran from north of



James Sawders

A Gothic figure guards the town of Conde on the Moselle

Cologne eastward to Regensburg (Ratisbon) and Vienna

We do not know a great deal about the ancient Germans except that they were divided into many tribes The people seem to have won a living from the soil and to have put much emphasis on family life Those who lived under Roman rule south of the *limes* rendered Europe an enormously valuable service by practicing the art of farming Colonies of these farmers were settled by the Romans in various parts of the Empire for instance in Spain where they brought vast areas of waste land under cultivation

But the unconquered tribes north of the *limes* though they had some contact with Roman civilization, were unable to establish a well ordered society Meager information about their religious beliefs and their military history can be gleaned from the German epics, notably the EDDA and the SONG OF THE NIBELUNGS The tribes of eastern Europe some of them Germanic others Slavic finally gained the upper hand swept across Germany, and eventually invaded the Roman Empire

Chaos followed the collapse of Rome Then came attempts of tribes known as the Goths and later attempts of other tribes the Vandals to rule Europe These drives had a very notable effect upon the development of central Europe Slavic Germanic and Celtic tribes became so interwoven that what might once have been called a German race ceased to exist The territory east of the Elbe became predominantly Slavic while the German tribes in the west pushed into France Indeed France gets its name from one of these tribes—the Franks

CHRISTIANITY COMES TO THE GERMAN TRIBES IN THE NINTH CENTURY

Second France provided the basis for a new social order This came about through the conversion of powerful Germanic chieftains to Christianity Religion now became the source of unity and order In accordance with what they understood to be its teachings Clovis and Charles Martel leaders of the Franks set about fashioning a kingdom This took on definite form under Charlemagne (768 814) Having established the seat of his rule in Aachen this truly great if often merciless king subjugated the Saxons and compelled them to accept Christianity He also fostered the arts of peace He believed in education and founded the first Christian schools in northern Europe

In the year 800 Charlemagne was crowned at Rome with the new title Emperor of the Holy Roman Empire He was thus given dominion over a vast area—what is now France and part of Spain most of Italy Switzerland western Germany and other sections of central Europe Neighboring tribes and countries were allies or owed some sort of allegiance to him Yet this empire was not a nation but a sort of federation of European peoples and those who cherished the idea on which it was based were convinced that it made possible a Christian dominion in which peace could be preserved

Unfortunately, Charlemagne's successors could not maintain the unity of the realm Rival factions began to quarrel and the various tribes fought and schemed against one another Finally in 843 the Frankish and German portions of the Empire were separated The German kingdom thus created was about the same in extent as the Germany which came into being temporarily as a result of the Pact of Munich (1938)

During several centuries thereafter, German rulers strove to retain control over the unruly noblemen who were their subjects and to preserve for their families the title to the Imperial Crown which could be bestowed only by the Pope First came a line of Saxon monarchs, notable for their energy frugality and religious feeling In their time

monasteries were founded and a high spiritual fervor was fostered The ruling classes of Germany gradually became deeply religious and interested in the welfare of Christendom as a whole Unfortunately, in these feudal times the masses of the people were very badly off They, less enlightened than the nobility, often practiced the old pagan religions side by side with Christianity

THE SALIC DYNASTY OF FRANKISH KINGS

After the line of Saxon kings came a number of Franconian rulers, they were of the Salic tribe and so the line or dynasty is often called the Salic, or Salian dynasty The first two Salic emperors were strong and powerful but the next one Henry IV (1050-1106), was embroiled in conflicts most of his life His heaviest struggles were with the Pope who wanted to make certain reforms in the church government Henry opposed them, since they interfered with some of his feudal privileges There was a violent quarrel but Henry was compelled to submit

Tension mounted throughout the era of the Crusades These armed expeditions to wrest the Holy Land from the Turks aroused strong popular feeling which sometimes found expression in fanatical excesses Thus the Rhenish cities (cities of the Rhine) witnessed pogroms which led to killing expulsion or forced conversion of many Jews On the other hand many of the Crusaders themselves were affected by the moral laxity of the East Others became deeply discouraged because lasting victory over the Moslem was not achieved

After the Salian emperors there was one more Saxon emperor, and then the Hohenstaufen dynasty The most brilliant of the Hohenstaufen emperors was Frederick II (1194 1250), grandson of Frederick Barbarossa, one of the famous Crusaders Changes in the German outlook are reflected very clearly in the life of Frederick II Reared in Sicily, which had become a flourishing part of the Empire he was educated by Greek and Arabian teachers He knew several languages and understood science He became an author and a lover of the arts. He was not a religious man Frederick took little interest in the affairs of Germany, which he seldom visited and so the German princes seized their chance to increase their power and influence As a result, the unity of the Empire could not be maintained after his death

Now the Papacy and its Italian allies were hostile to the Holy Roman Empire for Frederick had created a state that was divorced from religious purpose

After the death of Frederick II the kingdoms and principalities of the Holy Roman Empire began to fall apart and there was an Interregnum as historians call it lasting until 1273 Interregnum means a kind of recess To be sure there were emperors during the Interregnum but they had no real power or importance and although after the Interregnum the Empire again blossomed it never regained the vigor of its early years

During the twelfth and thirteenth centuries life in Germany was greatly affected by the rise of cities Their fortifications which were usually strong walls surrounded by moats assured safety and thus encouraged trade and industry The homes of wealthier citizens were often several stories in height beautifully adorned with ornamental woodwork and capped with steep roofs Hygiene and lighting were primitive

Many of Germany s most illustrious churches were built and to some extent



James Sanders

A medieval air lingers in this cobbled old Berakastel street, with its peak-roofed houses.

adorned with masterpieces of sculpture dur ing this era

The wealthier princes maintained splendid courts where religious devotion was ardently practiced and where at the same time there was intense interest in the literary work be ing done in Italy and France But as Wag ner s Tannhauser reminds us the courtiers listened also to the minnesingers or poets of love who sang the praises of fair ladies and in so doing proved that the German language could be used for noble poetry

During this medieval period the Teutonic Kn ghts were organized This was one of several military orders founded during the period of the Crusades Those who became kn ghts pledged themselves to live unblem ished lives of service in accordance with a religious rule Early in the thirteenth cen tury, the Teutonic Knights were invited by the King of Poland to assist in subduing the Prussians then a heathen tribe dwelling in the marshes and woodlands south of the Bal tic Sea This mission was successfully ac compl shed and the kn ghts went on to colo-nize a vast area. They built towns some of which were affiliated with the Hanseatic cit ies They erected castles of wh ch the Mari enburg just south of Danzig is the most im pressive example And they Christianized the northeast of Europe But in time they quarreled with the Polish sovereigns and were themselves weakened by worldliness and greed The government they established was often oppressive In their best days they were however gallant Crusaders and they were well in advance of their period in his-tory as engineers and colonizers



Photo f om European

Straining milk through a double sieve in a dairy

THE HAPSBURGS BECOME THE MOST POWERFUL FAMILY IN CENTRAL EUROPE

The Interregnum ended in 1273 when a Hapsburg prince was elected emperor In the years that followed the crown passed from one dynasty to another to come back at last to the Hapsburgs These princes had their seat in Vienna Austria and their task was to defend the boundaries of the realm in the west while warding off attacks by the Turks in the east Austria controlled Burgundy a dukedom in France and to Burgundy the Austrians owe the customs and manners that we think of as Austrian to this very day Yet because the power of the sultans was for so long felt as a threat to her eastern bor der Austria came to be concerned with civi lization in eastern Europe Thus she looked both ways

The rule of the Hapsburgs was never tran quil in the political sense but well be ng in creased among the people nevertheless This was the age of the guilds those associations of master craftsmen to which central Europe is indebted for a great deal of its finest art and some of its most beautiful cities (World War II unfortunately destroyed much of the legacy of the guilds)

After the Crusades Germany became a center of traffic between the East and the West A rich trade in furs and damasks and spices assured the Western world of these luxuries while textiles and other wares went from France and western Germany to the Last

Meanwhile older rel gious loyalties were being undermined First came a reform movement led by John Huss a Czech theo logian who was also a popular preacher Huss was condemned to death and executed for heresy whereupon his followers rebelled and were crushed in a bloody war Then Martin Luther an Augustinian monk began to advocate ecclesiastical reforms. On Octo ber 31 1517, he nailed on the door of the ducal chapel at Wittenberg a scroll setting forth ninety five theses which he declared himself ready to defend Thereby the era of religious change known as the Reformation was inaugurated The creed of the reformers came to be known as Protestantism.

A movement within the Catholic faith led

James Sawders



An arithmetic lesson in a country school in Bavaria The children are using old fashioned slates and all the little girls have pigtails

by the Society of Jesus, followers of St Ignatius Loyola, is termed the Counter Reformation No compromise was reached and Germany was divided into two hostile camps Most of the North became Lutherans while the South largely remained Catholic Sharp conflicts were frequent, and in addition a Peasants' Revolt showed the general dissatisfaction and restlessness of the times

Even so, the era witnessed a great increase of interest in civic affairs as well as the growth of the middle class In the arts Germany was influenced in part by the Italian Renaissance, and in part by the genius of the Netherlands This was an era of great masters in painting and sculpture Literature also made great strides

In architecture, influences coming from Renaissance Italy soon gave way to a more ornate style known as the Baroque The older buildings of the Romanesque and Gothic periods were preserved, but churches, houses and civic buildings in the new style were added, so that many cities took on an unusual charm and variety People were prosperous and there was a greater measure of comfort than any earlier generation had known Some prominent families were very wealthy, and precious metals were used lavishly in making the furnishings for patrician houses

This era of prosperity was ended by the outbreak of the Thirty Years' War (1618-1648) In its earlier stages this destructive conflict, rooted in the rivalry between Protestant and Catholic princes, centered round the control of Bohemia The armies of the Catholic emperor were temporarily victorious There followed a war between the Germans and the Danes, which ended when the Peace of Lubeck was signed in 1639 During this conflict the imperial forces were for the most part commanded by Wallenstein, an able general of doubtful character Soon a powerful Swedish army, commanded by King Gustavus Adolphus invaded Germany in support of the Protestant forces This army won notable victories but was defeated after the Swedish king had fallen in battle

Later a Franco-Swedish alliance waged war once again, and wrought terrible havoc in Germany So many lives were lost and so much treasure was consumed that a universal longing for peace set in The Treaty of Westphalia, signed in 1648, fixed the religious boundaries of the German states It also, to a considerable extent, determined the outline of modern Germany War was held in abhorrence by the German people for a long time and plans for the preservation of peace were everyday topics of discussion The most significant of these was outlined during the following century by the great philosopher, Emanuel Kant (1724-1804) He advocated a league of European nations pledged to settle disputes

Germany was now (1648) made up of a great number of independent principalities, duchies and free cities In the majority of these small states, a court was pledged to uphold the religion professed by either the majority of the citizens or by the ruler Many of the states were governed by absolute monarchs, who exercised unlimited sovereignty over their subjects The proud burghers (independent city men) of previous centuries were almost extinct Many Germans were actually sold by their princes to other nations as soldiers You already know of the Hessians who served in the British armies during the American Revolution These troops were recruited by force and shipped abroad



James Sawders

Wartburg house where Luther translated the Bible

France had become the dominant power on the Continent The age of King Louis XIV (1638 1715) in particular was a period during which French taste and French ideas shaped the culture of a backward and pov erty stricken Germany The Hapsburgs still were nominal rulers of the Empire but very gradually the Kingdom of Prussia became powerful This hitherto unimportant state consisted originally of the territory of Bran denburg in northeast Germany and had been enlarged primarily through the purchase of territory from the Teutonic Knights It was ruled by the Hohenzollern family and at this point it was autocratically but frugally and efficiently ruled A standing army was organized in Prussia because such a force was deemed to add luster to the ruling house

It suddenly became evident that the little state possessed a very gifted, cynical and, upon occasion, warlike monarch Frederick II, called the Great (1712 86) He was also a dabbler in the arts, and a friend of the French philosopher Voltaire. Within a few years, Frederick had wrested the realm of Silesia from his rival, the Empress Maria Theresa of Austria, and had shared with Russia and Austria in the Partition (cutting up) of Poland When Frederick the Great died in 1786, Prussia had become a strong and populous state

Toward the close of the seventeenth cen tury, the people throughout the German states began to recover a measure of pros perity The southern regions of the country witnessed the development of an ornate ar chitecture Splendid monasteries churches and palaces were erected The traveler who has studied these great buildings can not for get the extraordinary skill with which the architects blended new ideas with what re mained of an older art

LITERATURE AND MUSIC REACH GREAT HEIGHTS IN THE AGE OF GOETHE

Literature, too, slowly revived During the eighteenth century there was a rebirth of German poetry influenced greatly by Eng lish models Heights attained neither before nor later were scaled in the work of three masters—Goethe, Schiller and Hoelderlin Johann Wolfgang von Goethe was also one of Germany s greatest dramatists, and a nov elist of power

Friedrich von Schiller (1759 1805) was a South German devoted to the ideal of free dom He exercised a profound influence upon later generations of Germans During many decades Schiller was the poet from whom young Germany learned a code of idealistic service Friedrich Hoelderlin (1770-1843) also a South German was less well known during his lifetime than were his fellow poets Yet he is possibly the foremost lyric poet of the German people, though he is not the easiest to understand

The period after the Thirty Years' War witnessed the magnificent development of German music, under the patronage of princ es and aristocrats. The first illustrious mas ter was Johann Sebastian Bach (1685 1750), writer of both choral and instru mental music and a man of singular sweet ness and nobility of character His music remains, in the opinion of many students, unsurpassed for richness and depth

The work of Bach inspired such eminent composers as Handel (1685 1759), Haydn (1732 1809) and Mozart (1756-91) To them humanity owes an art of magnificent intricacy, which has cast its spell upon every generation since their time Mozart was also the first great writer of German opera These three were followed by Ludwig van Beetho ven (1770 1827) a genius whose work, which included virtually all the musical forms, contains both the legacy of the past and the promise of the future

Thus, despite its lack of political organi zation and the bleak poverty of many of its people, Germany had become, at the close

of the eighteenth century, the home of great poets, artists and thinkers For the most part, such men were dependent upon the good will of some prince who desired to grace his court with the prestige of their names On the other hand, many of the monarchs were willing to accord liberty of expression to men of genius and talent

NAPOLEON DIVIDES THE GERMAN STATES INTO TWO CAMPS

Then the long process of political change in France, to which the name of French Revolution is applied, had its turbulent beginning It was welcomed by many German intellectuals, but opposed by the rulers who strove to defend the cause of Louis XVI and his Austrian born queen, Marie Antoinette An alliance entered into by Austria and Prussia in 1792 constituted a threat to the newborn French Republic France introduced conscription, declared war and forged a great and enthusiastic army on the anvil of national sentiment After Napoleon Bonaparte assumed command of this army, the defeat and virtual conquest of all Germany began Bavaria and other South German states became allies of Napoleon In Austria and Prussia, however a fierce desire for liberation was enkindled

First some of the Austrian mountaineers rallied round the Tyrolese patriot, Andreas Hofer, but they were defeated after a number of indecisive victories Next, the Prussians rose in 1813, but they lost two bloody battles to Napoleon The cause of Germany seemed hopelessly doomed, though the resolute spirit of its best men did not flag After Napoleon's retreat from Moscow, a grand alliance brought Prussia Austria, Russia and England together The French emperor was then defeated at Leipzig and forced to retreat to France. Eventually he was beaten soundly by the Allies at the Battle of Waterloo (1815) The Napoleonic era was over

DESIRE FOR UNITY UNDER ONE RULER STIRS ALL GERMANY

In this fighting a new Germany had been born It had made heavy sacrifices for liberation and now it desired the unity of all Germany under a constitutional monarchy It had been deeply influenced by the French Revolution and by liberal German philosophers, Fichte, for one Now thinking Germans in all the states came out strongly for reform

The peace conference, known as the Congress of Vienna, doomed these hopes to extinction Austria and Prussia did not merge each was bent on enlarging its own territory and both succeeded In both countries, a reactionary monarchist government gained additional strength and paid only lip service to the plea for more democratic government Prussia did not receive the constitution which its ablest citizens desired although Baron Heinrich von Stein succeeded in reforming local administration In short the Holy Alliance, as it was called, of the four victorious powers—Austria, Prussia, England and Russia—prevented the creation of a new and liberal Germany

This was a fateful hour in modern Germany The demand for unity and reform did not cease, but hopes grew dim except in intellectual circles which formed particularly in the more liberal minded South German cities Some good resulted from the rule of Napoleon For one thing, the Jews were given an equal status

NEW INVENTIONS AND FACTORIES CAUSE UNREST AND CONFLICT

Meanwhile, the way of life was everywhere changing, as inventions threw out hand work in many lines and set factories running in town after town The differing interests of capital and labor began to show up Both business men and spokesmen for labor began to be heard Ferdinand Lassalle (1825 64) sponsored a movement to foster state socialism He was followed by Karl Marx (1818 83), who was led by a study of industrial conditions in England to proclaim a doctrine of class warfare A strong movement to effect social reforms developed in the Catholic regions of western Germany

FIRST ATTEMPTS FAIL TO MAKE A CONSTITUTION FOR ALL GERMANY

Public sentiment asked for a "parliament to organize constitutional government for a unified Germany After much preliminary discussion, a National Assembly met in Frankfort during May, 1848 It adopted a bill of rights and wrestled earnestly with the problem of German unity But a series of unfortunate events led to the defeat of the liberal cause Uprisings in various parts of the country were put down by troops The principal revolutionists of 1848 sought refuge abroad, and many came to the United States Among these was Carl Schurz, friend of Lincoln

Prussia next stood forth for German unity At first her motive was a real desire for liberal government Then (1862) Prince

Otto von Bismarck was appointed president of the Council of Ministers by the Prussian king This able, resolute and often unscrupulous man turned Prussia from the liberal way and toward a harsh, arrogant spirit

THE DEFEAT OF FRANCE IS A TRIUMPH FOR BISMARCK AND PRUSSIAN IDEAS

Bismarck was lucky A victorious war with Austria was followed (1870) by the outbreak of war with France The result was a dazzling triumph for Bismarck and for Prussia Under the leadership of General von Moltke, the armies of the German states, marching side by side for the first time crushed the French forces opposing them in the bloody Battle of Sedan France still weakened from the Napoleonic Wars, was not able to carry on She sued for peace

The treaty was signed at Versailles near Paris, and the terms dictated by Bismarck were pitiless France had to sign Alsace and Lorraine over to the German Empire, a new, powerful organization of the German states created there at Versailles The Prussian king became the first emperor, or Kaiser as Wilhelm I The Constitution which Bismarck gave to the new empire assured the supremacy of Prussia inside Germany Bismarck himself became chancellor a position in which he was able to exert great power The Iron Chancellor, they called this stern man, whose influence was so far reaching

GERMAN POETS KEEP ALIVE THE IDEA OF FREEDOM

Artistic and intellectual life between 1800 and 1871 lacked much of the simple greatness of the age of Goethe Nevertheless, it was rich and varied The poets and thinkers of the time of the wars against Napoleon were followed by others who gave their hearts and their genius to the cause of freedom at home These belonged to many groups Heinrich Heine, author of some of the best known lyrics in the German language, was Jewish, while Joseph von Eichendorff, who lived at the same time, was the great Catholic poet of southeastern Germany Among the younger men who were passionately interested in the outcome of the Revolution of 1848 was Richard Wagner, later on to become one of the most illustrious creators of opera

So now, after the Versailles Treaty of 1871, the Germans were united It appeared that they had secured union under a constitutional monarchy by reason of a successful war This gave rise to a militaristic spirit destined to have the most somber consequences Many Germans reveled in the feeling of strength, and applauded the iron discipline which they deemed responsible for the victories gained Bismarck, it is true, believed that the new German Empire was sufficiently powerful, and he strove earnestly to maintain the balance of power in Europe He courted the good will of Russia, Great Britain and even France, while at the same time he strove to make the Prussian way of life dominant inside Germany That he did not succeed in the second endeavor was largely due to the savage, but unprofitable, attack he waged on the Catholic Church This episode is known as the *Kulturkampf*

WILHELM II PROVES TO BE A STUBBORN, WARLIKE RULER

Then (1888) Kaiser Wilhelm II came to the throne, and almost immediately declared himself at odds with Bismarck The great Iron Chancellor was compelled to resign He was followed by a series of weak statesmen who attempted, on the one hand, to carry out the Emperor's blindly unreasonable policies, and, on the other hand, to soften the effect of his foolish and warlike speeches Wilhelm was not without intelligence and shrewdness, but he was unbalanced abnormally sensitive and influenced by romantic and dangerous ideas Thus he became interested in the doctrine of Aryan supremacy

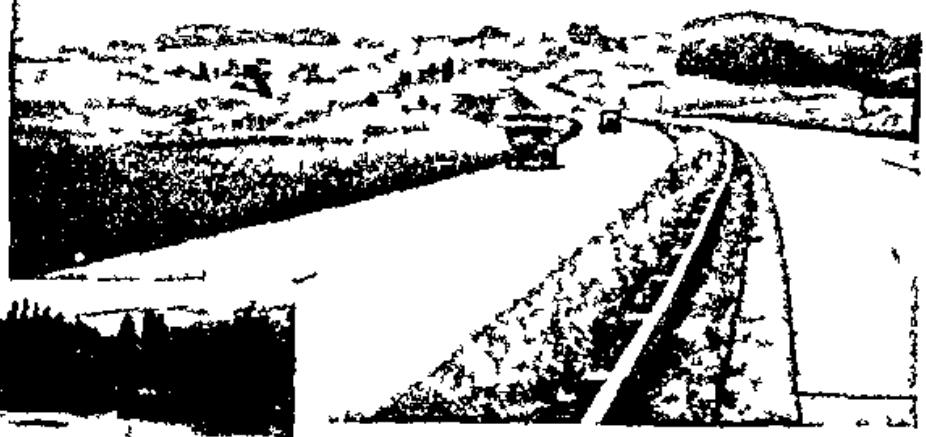
The ablest chancellor of this period was doubtless Bernhard von Buelow (1849-1929) He seems to have been guided by the belief that so powerful a state as Germany should not court the good will of other countries but should select, from offers made by others, the most suitable friends In order to get such offers, Germany relied on stressing its might and its willingness to fight As a result of this arrogant attitude, the British Government, which had sought an alliance with the German Empire, turned instead to France England and France formed a friendly sort of agreement, called the Entente Cordiale, in 1904

GERMANY CONFRONTS THE WORLD WITH A POWERFUL NAVY

Kaiser Wilhelm was now building a strong navy, possibly to impress the world with Germany's strength, possibly merely to impress his royal British relatives with his grandeur (Wilhelm was a grandson of Queen Victoria, and therefore a nephew of King Edward VII) You may be sure the German fleet which was being built just

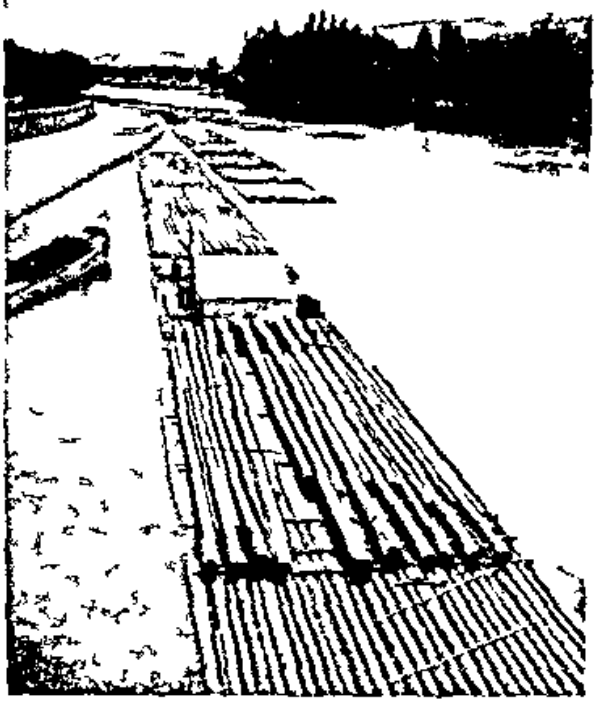
Screen Tra eler
f om Gend eau

Modern highways like his were built all over Germany under Hitler—but *not for the convenience* of travelers. They were intended for the rapid transport of armies



James Saw le s

Logs being floated down he Main River through the lovely Bavarian countrys de.



across the North Sea was noted by the British public Meanwhile relations with Russia had likewise grown less friendly and even the German position in Turkey was open to serious doubt When Buelow was followed (1909) by Theobald von Bethmann Hollweg it was plain that the only ally upon whom Germany could rely was Austria

The years after 1870 were marked by changes in thought among the people Education improved, but it seemed to be putting material things above spiritual welfare There was an intense interest in science Life at the courts was without intellectual luster and suffered by reason of the harsh formalism of the military caste Bad manners in Berlin and elsewhere did not destroy the courtesy and simplicity of German folk life But brawls among student fraternities were common and duels were regarded as honorable

Toward the close of the century a significant change set in both in scholarship and in the creative arts German youth turning once more toward the idealism of Schiller became deeply critical of the formalism and materialism of German life under the Empire

During the summer of 1914 storm clouds began to form over Europe On June 28 Archduke Franz Ferdinand heir apparent to the Austrian throne was murdered at Sarajevo a Serbian town Count Leopold Berchtold Austrian foreign minister regarded the assassination as a reason for curbing Serbia the ambitions of which were viewed with alarm by the Hapsburg Empire Berchtold discussed the matter with Kaiser Wilhelm II and the German Chancellor who agreed that stiff demands should be sent to the Serbian Government Learning of this action, the Russian Government intervened declaring that it would not countenance any threat to Serbia (like Russia a Slav state)

Before issuing this warning the Russians had conferred with the government of France Now the Russians ordered their troops to be mobilized (made ready for possible war) Kaiser Wilhelm was now aware of the seriousness of the situation He endeavored to induce the Russians to countermand their order of mobilization In this he was unsuccessful and his chancellor was equally unsuccessful in an attempt to soften the demands of Austria

The results of German diplomatic blun

dering after the days of Bismarck were now apparent The only dependable ally was Austria and so Austria could not be left in the lurch On the other hand Austria had been so impressed by German bluster and arrogance that she seemed to be acting in the spirit of Berlin On July 31 Germany proclaimed a state of war and by August 4 Germany and Austria were committed to war against Serbia Russia France and Great Britain No one foresaw what the conflict thus started would ultimately cost in blood treasure and social stability In many countries soldiers sang and laughed as they left for the front Each nation believed in the righteousness of its cause And yet each bore a heavy measure of responsibility for the catastrophe which soon engulfed the world

The Germans must be blamed particularly for the unfriendly, saber rattling policy of Kaiser Wilhelm because this policy had helped to divide Europe into hostile armed camps Now the German High Command added heavily to German guilt by marching into neutral Belgium on the way to France The Belgians offered fierce resistance and the civilian population suffered grievously When the German chancellor Bethmann Hollweg referred to Belgian neutrality as a scrap of paper public opinion throughout most of the world turned against the Germans

German armies defeated a French attempt to invade Alsace and sent a powerful force wheeling southward toward Paris French and British forces rallied however and in a series of engagements known as the Battle of the Marne brought the Germans to a halt Meanwhile, the Russians drove into East Prussia but failed to take advantage of their opportunity Commanded by Generals von Hindenburg and Ludendorff German troops overwhelmed a great Russian army at Tannenberg During more than three years thereafter in the east the line of battle moved to and fro On the western front fighting was back and forth over a narrow belt Millions of French British and German troops fought and died in the mud and filth of trenches expending precious life-blood on offensives which gained only a little battered ground



Photo from European

"Flour" from wood a wartime German product

In the spring of 1917 events began to move faster In March a revolution broke out in Russia The new government headed by Alexander Kerensky remained friendly to the Allies But General Ludendorff now virtually the dictator of Germany carried the exiled Nikolai Lenin (a disciple of Karl Marx) to Russia from Switzerland In a short while Lenin and his followers ousted the Kerensky Government and decided to take Russia out of the war So they asked Germany for peace terms

THE UNITED STATES ENTERS THE FIRST WORLD WAR AGAINST GERMANY

Meanwhile however the government of the United States had become involved in a dispute with Germany over the conduct of submarine warfare President Wilson asked Congress to declare war on Germany, and such a declaration was made on Good Friday April 6 1917 Fresh and powerful American armies landed in France and the United States Navy started to cope successfully with the German submarines The Germans launched a final great drive on the western front during March 1918 but this failed and heavy pressure began to force them back toward the Rhine

At the request of Ludendorff who admitted that the war had been lost a new German Cabinet sued for peace The Kaiser fled to Holland and on November 11 1918 the German Army was granted the armistice which its High Command had requested An armistice is a temporary stop in fighting In this case fighting was never resumed There could be no doubt that the Kaiser's powerful military machine had been badly beaten It had no reserves of man power its supply problems could no longer be solved and it was without either tanks or an adequate air fleet The people at home were in grave danger of starvation On the other hand the morale of the troops was actually better than the High Command supposed



James Sawders

German porcelain is justly famous, and here the fragile figures are being painted in delicate colors.

The change back from war to peace in Germany was chaotic A sort of revolution was attempted by left wing labor groups impressed by the victorious revolution in Russia. This was opposed by the trade unions which were promised the support of the High Command in maintaining orderly government A republic was proclaimed but for some months violent fighting raged in various parts of Germany Sometimes the government in the towns broke down completely The transportation system and the distribution of food and fuel were seriously impaired In addition, the terms of the Armistice imposed heavy burdens which further drained the resources of the country

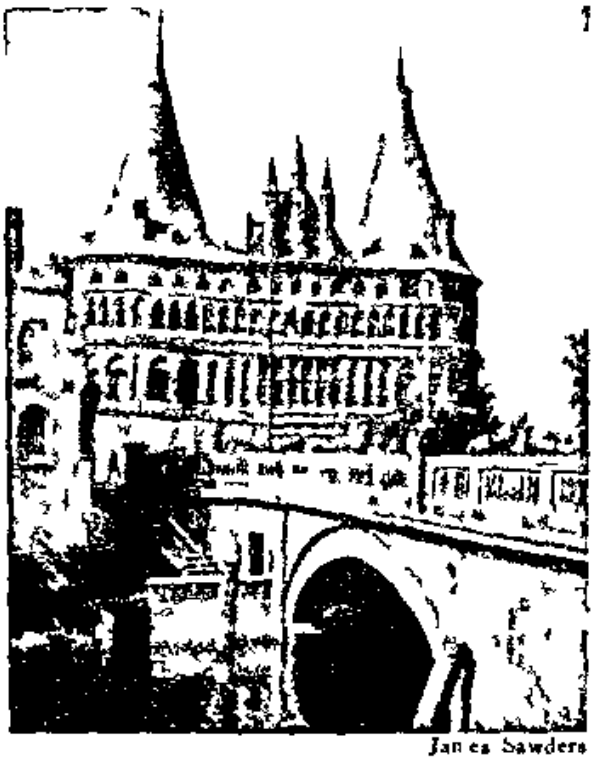
Nevertheless the officials succeeded in restoring order and conducting a free election of delegates to a National Assembly which was to write a constitution Desire to create a democratic Germany was general and sincere To be sure a strong monarchist faction still existed but there was a great democratic majority led by men with experience in government They may not have been brilliant but they were inspired by sound patriotic motives The constitution adopted at Weimar was genuinely liberal but it had grave faults which would be revealed later on during years of stress and strain

The new Weimar Government was forced almost immediately to deal with problems of the utmost magnitude First was signing the Treaty of Versailles There can be no doubt that the effect of this treaty inside Germany was a serious obstacle to democratic government The Allies imposed hard terms upon the conquered foe and those Germans who were not in sympathy with the democratic way of life blamed the new government for agreeing

Though some of the demands for territory made by the Allies aroused strong resentment it was the size of the reparations which caused the greatest dissatisfaction Food and other supplies could no longer be procured except at prices which strained the citizen's budget industry could be brought back to peacetime use only very slowly and the general tension and bitterness resulted in a trend toward radicalism which threatened the republic

There was another difficulty arising from the class society of the past which still to some degree lived on Friedrich Ebert the first president had once been a saddler (leather worker) He was a man of excellent common sense and strong character but neither he nor most of his associates had the aristocratic background of the old time German officials A government in which labor unions played a dominant part could not find many trained men for important positions of state unless it accepted the co-operation of more conservative groups

In addition the Treaty of Versailles permitted a German army of 100 000 men This standing army, popularly known as the Reichswehr remained conservative even reactionary, and was in a position to aid discontented veterans who were trying to maintain secret military organizations



Jan ca Sawders

One enters this 15 h century Lübeck gate below

The third major problem was created by the decision of France to occupy the Ruhr Valley and seize German mines and industries there as pledges for the payment of reparations The Germans countered this move with passive resistance which ended by completely undermining their currency The mark ceased to have any real value when in December 1923 it was worth only one billionth part of what it had been worth before the war Speculation was unrestrained The middle classes were reduced to absolute poverty and the whole social structure of Germany changed without benefit except to a very few profiteers Resentment reached feverish heights

Many now sought to become spokesmen for the dissatisfied and disinherited Among them was one who at first seemed insignificant. His name was Adolf Hitler an Austrian who had served as a lance corporal in the German Army, and was now in the pay of the Reichswehr of Munich as a propagandist and spy Hitler made influential friends notably General Ludendorff and he attempted to seize power in 1923 Such an attempt is called a *Putsch* (push) in German Hitler s *Putsch* was easily put down and for some years thereafter Hitler was little noticed He was in prison for a while He was persistent nevertheless and the organization of his party, National Socialist went on side by side with the organization of the equally extreme Communist party

German finances were aided by loans from the United States and between 1924 and 1929 the country enjoyed a period of relative tranquillity and prosperity Industries were modernized and public utilities improved The government encouraged and aided housing projects The inflation had virtually wiped out the class that lived on income By 1928 approximately half the population—32 500 000 men and women—were gainfully employed Of these, 29 500 000 earned less than 200 marks or $50 a month From these earnings taxes and social security were deducted In view of the social benefits he enjoyed the German citizen was not too badly off but he rarely had any savings It was clear that if unemployment should increase very much or if the flow of foreign credit should cease there would be trouble

When the great depression started in America in 1929 German business and credits were affected and unemployment began to increase rapidly Soon a depression of terrible magnitude compelled the German Government to resort to drastic measures partly in the hope of settling once and for all the reparations question Unfortunately the machinery of international discussion could be got into motion only very slowly The president of Germany at this time was the former Field Marshal von Hindenburg grown very old with little left of his former vigor

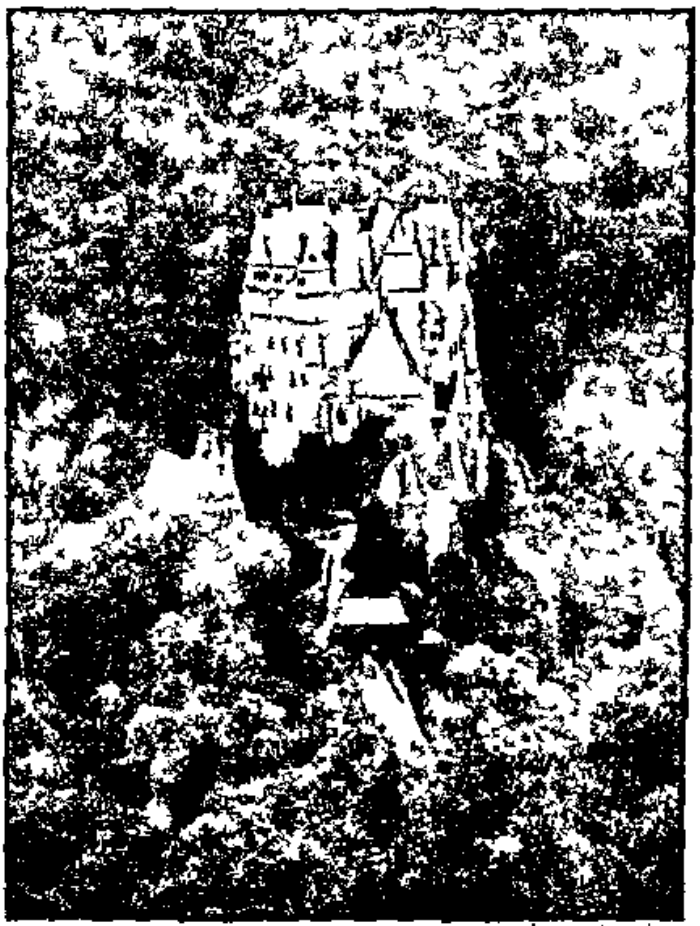
YOUNG GERMANS ARE DRAWN INTO THE NAZI MOVEMENT

During this crisis the Hitler movement as well as the Communist party, began to grow The Hitlerites profited especially by the fact that young voters going to the polls for the first time were attracted by the uniforms, stipends (small salaries) and ceremony of the party members The generation born during the war was coming of age An astute journalist had predicted that by 1930 these voters would elect more than 100 Nazis to the Reichstag This prophecy was based on insight into the mind of a generation that had grown up amidst violence inflation, disorder and bitterness Too much stress can not be laid upon the destiny of these young people. Even though the nazi movement was the creation of discontented World War I veterans who could not find their way back into civilian life, it was youth that transformed the movement into a strong party

Further support came from quite different

quarters—from certain sections of the steel industry, and from industrialists and Junkers (owners of big country estates) These men believed in a corporative social order which, they frankly admitted would have to be established by the aristocrats and the employers Thus they favored throwing democracy out the window A favorite argument was that a nation's industry could not earn the social benefits desired unless it were so conducted that there would be enough left over to pay the cost of welfare institutions Business men who held this idea imagining that Hitler agreed aided the nazi cause

In the fall of 1930 107 nazi delegates were elected to the Reichstag From then until January 1933 when Hitler was named chancellor the tide of radicalism grew mightier in Germany in spite of occasional setbacks Many German voters believed that they must choose one extreme or the other—communism or nazism Only the trade unions and religion were any longer able to muster support for a moderate position



James Sawdon

A castle fit for the Sleeping Beauty near the Moselle

Just before new elections were held in March 1933 the Reichstag was set on fire probably by Nazis Hitler threw the blame on the Communists The fear of communism which had been present from the very beginning of the Republic, was now stronger by reason of constant street fighting and political agitation. This anxiety served as the excuse for suppressing the Communist party by decree The elections marked by tumult and bloodshed were held in an atmosphere of high tension with nazi storm troopers patrolling the streets When the ballots of those who were still allowed to vote were counted the Nazis and their conservative allies were found to have a meager majority of 52 per cent

No sooner had the results been announced than a reign of terror commenced Marxists (Communists) Jews Catholics and pacifists were tortured and beaten murder was part of the daily routine The Nazis took over state governments and ousted the officials of the chief towns Frightened by threats of violence the Reichstag proceeded to pass an act which gave Hitler absolute authority for a period of four years This act the Nazis at once used in order to destroy all political opposition The conservatives were the last to give way But in a blood purge in 1934 aimed mostly at them, Hitler executed more than 1 000 persons without trial President von Hindenburg and the Reichswehr did not even attempt to hold the Nazis responsible for this act of mass murder Resistance to Hitler inside Germany broke down almost completely

On June 6 1936 the German police were brought under the command of Heinrich Himmler This act on placed the Gestapo or secret political police in the driver's seat During the same year Hitler also made two important decisions having the gravest effect upon international order First he denounced the Pact of Locarno which had laid down the western boundaries of Germany and he marched troops into the Rhineland a zone around the Rhine River where an armed force was forbidden according to the Versailles Treaty Second the Rome-Berlin Axis was formed an alliance between Italy

and Germany Japan joined the Axis a month later The world looked on, and did nothing to prevent these acts

As early as 1935 Hitler had declared that Germany would no longer agree to remain disarmed and he had ordered conscription he had arranged a secret naval treaty with Great Britain and he had managed to secure foreign credits for the purchase of nickel copper and other raw materials needed by the armament industry Even more notable is the fact that in 1937 he was able to erect a strong wall of defense along Germany's western border This he thought would make it impossible for France to attack He also secured in 1937 industrial aid from abroad

Intoxicated by these successes and in complete control of the government Hitler became unrestrained The younger generation was ardently on his side Boys and girls young men and young women, accepted the nazi doctrines without question and almost worshipped Hitler as their Fuhrer their leader He had the country with him He had soldiers trained in the most modern forms of warfare He had the weapons

AUSTRIA IS THE FIRST COUNTRY TO FALL UNDER THE NAZI YOKE

By the spring of 1938 he was ready to move Austria was the first victim Hitler demanded *Anschluss*, that is the joining of Austria with Germany There were some Nazis in Austria who wanted *Anschluss* The government in Vienna called for a plebiscite (general vote) on the question but before the vote was taken an armed German force started marching The Vienna government gave in and Austria as an independent country no longer existed it became but a province of Germany Vienna and other Austrian cities were 'purged' of the opposition During two days, more than 50,000 persons were herded into concentration camps where many of them died after brutal abuse The banks of the country were looted, and Hitler acquired substantial amounts of gold and other forms of foreign exchange

CZECHOSLOVAKIA IS "SOFTENED" FOR CONQUEST

Czechoslovakia was now sorely threatened, and a propaganda campaign against that unhappy country was soon in full swing It was alleged that German residents there were being mistreated The British Government dispatched a commission to study the question Since France was pledged to come to its assistance, the Czechoslovakian Government adopted a firm attitude, and during the summer of 1938 a general European war seemed almost certain

THE MUNICH PACT, A VICTORY FOR HITLER

At the height of the crisis, Neville Chamberlain, British prime minister, decided to visit Hitler at Godesberg, Germany This conference was followed by a meeting of the four major powers in western Europe at Munich, September 29—Great Britain, France, Germany and Italy Hitler emerged the victor Czechoslovakia was carved up and Germany secured a goodly slice. Although he had promised to respect the borders of the purely Czech regions of the little republic, few doubted that he would soon enter Prague, the capital, and take over the whole country This he did during March, 1939, and thus gained control of one of Europe's most important armament works, the Skoda plant together with stores of raw material and fleets of tanks amassed by the Czech army

The German victories had been truly stupendous, but Hitler wanted more He turned his attention toward Poland First he started a propaganda campaign, accusing Poland of atrocities committed on the persons of German citizens. But now the British, dismayed by the mounting threat of Hitlerism, and appalled by the evidence of brutality reported from inside Germany, decided to intervene The British Government promised to give aid to Poland if the weaker country should be attacked

POLAND NEXT—AND THE SECOND WORLD WAR BEGINS

Nevertheless, hoping that war might yet be avoided, Great Britain tried in vain to arrange a peaceful settlement of the most urgent dispute between Poland and Germany—the matter of a strip of territory, the Polish Corridor, which separated East Prussia from the rest of Germany President Roosevelt urged Hitler to solve the controversy without force A final peace move was made by the Vatican All efforts of the peacemakers were in vain

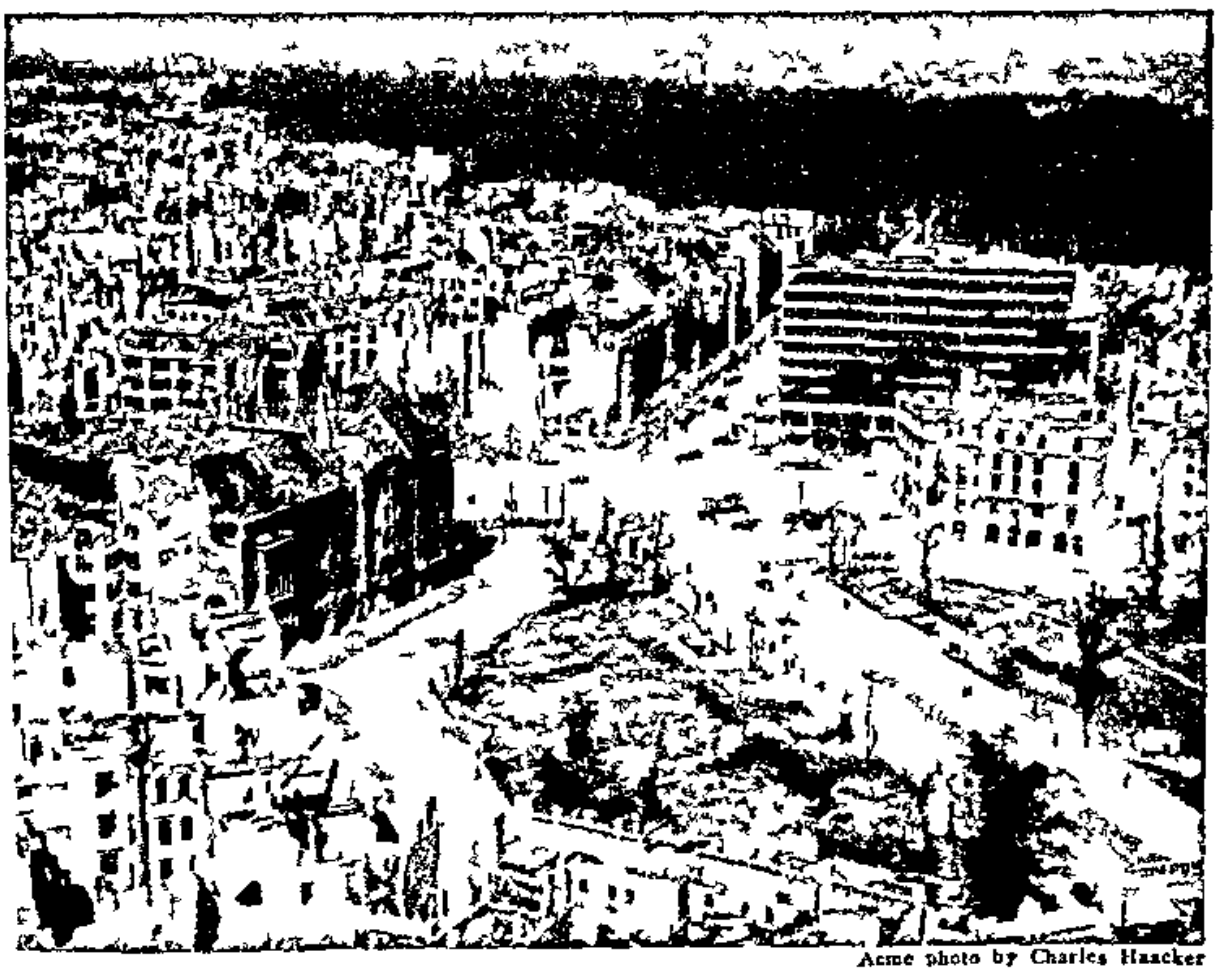
On August 23, 1939, a non aggression pact was signed by Germany and the Soviet Union A week later, on September 1, the German army invaded Poland without a declaration of war The armed forces of Great Britain and France were mobilized for action on the same day Thus began the great

est and most costly struggle in the annals of humanity Of the complete responsibility of Hitler and his benchmen for this tragedy there can be no doubt They are the authors of a catastrophe which will stagger the imagination for centuries to come

We have in these pages told you the important events of Germany s history You have seen in the ancient days the German tribes at war with one another and with the civilized world of Rome and with neighboring tribes to the north and east You have watched civilization move northward from Italy and France and the German tribal areas becoming states with growing wealth and learning and a deepening religious devotion You have seen how the states aligned themselves under the banner of the Holy Roman Empire As the centuries passed the states disagreed and fell apart again and in time were gobbled up one by one by Napoleon When Napoleon s sun had set one of the German states Prussia began to shove itself forward Its leaders lived thought and planned as military men and as victorious military men they brought the states together once more into a strong empire It became an empire striving for greater military glory it fought and lost a world war 1914 to 1918 and still was not convinced that the peaceful way is the better way of life for a nation So it brought on a second world war 1939 to 1945 and lost that one too

Now Germany lies desolate Many of her cities are in ruins Her people are suffering from the ills of unspeakable poverty She has no central government no great leaders no hope for the future In all the world there is not a country that loves or trusts her Today it appears that the story of Germany is the tragedy of a nation that destroyed itself

Yet nations must learn to exist together on this earth We shall have to work out a sober decent way of life for the German people so that never again shall their dreams of conquest plunge the world into the horrors of war



Acme photo by Charles Haacker

War s destructiveness came to the very heart of Berlin the once gay Potsdamer Platz. Most of the great cities of Germany are ruined and the nation is at the mercy of those she tried to conquer



GIRL GUIDES

By K Nadine Corbett

THERE is a great world wide sisterhood of girls which stretches like a chain around the world This is the chain of Girl Guiding In some countries it is called Girl Scouting The color of the uniforms is not the same in every country In very warm countries such as Brazil and the West Indies, white uniforms are worn In Canada Girl Guides wear the uniforms that you see on the Guide and Brownie in the picture

All of the girls in this huge family have taken the same Promise at their enrollment and have pledged themselves to do their best to keep the same ten point Law In whatever country they may be, you will find them camping hiking singing and learning

Did you know that the Girl Guides have younger sisters called Brownies? The Guides are divided into groups according to age Any girl once she has passed her seventh birthday, may join a Brownie pack and wear a brown uniform with its own badges The Brownies motto is Lend a Hand The Brownies promise is not quite such a big promise as the Guide Promise, because the girls who take it are not so big, but it is every bit as important The Brownie of the British Empire promises that she will do her best to do her duty to God and the King and that she will help people every day especially those at home

Brownies like Guides are expected to do one good turn every day but most Brownies do a great many secret good turns They learn to wash the dishes to make milk puddings to thread needles and sew on buttons as well as hundreds of other useful things which older folk do not really expect younger girls to know how to do That is one of the things that are such fun about being a Brownie—they are always learning to give the people at home pleasant surprises At the beginning of the war grownups thought that there was not much that a Brownie age person could do in the war effort One group of Brownies proved that the grownups were very much mistaken These Brownies went down to their local Red Cross workroom and threaded needles and loaded pin cushions for the ladies who were sewing there

The big sisters of the Girl Guides are called Rangers and their special job is to prove that all the things they learned as Brownies and Girl Guides really make them more useful citizens The Ranger is usually more than fourteen years old and under the age of twenty She is asked to carry her practical knowledge and the Guide spirit of her Law and Promise out into the wider world She is both an explorer and a pioneer

An explorer or a pioneer must be a brave and resourceful person and so the Ranger must train herself to meet every kind of emergency—the everyday emergencies that happen at home and the ones that are likely to happen in any town or village

Some Rangers prefer to specialize and become Sea Rangers These girls are particularly fond of the water They are organized as the crew of a ship and their Guider is their Skipper They learn to swim and to handle a boat and to know the weather lore that is necessary for navigating

Many Girl Guides when they grow up become leaders of Brownie packs or of Guide or Ranger companies Thus the chain of Guiding spreads, not only around the world but also up and down from one generation of Guides and Brownies to others yet to come into its ranks All those who have known the fun and inspiration of Girl Guiding feel for their sister Guides a very real and special friendship

GIRL SCOUTS

By
Anne L New

UP in Medford Massachusetts there is a group of girls from seven to ten years old who suddenly found themselves praised as authors artists and historians not only in the town of Medford but in a national magazine as well These young girls belonged to a Girl Scout Brownie troop What had they done that was so important?

These nineteen Brownies had given their town something to remember them by for years to come They discovered that there was no published history of their town in their library So they set forth to find out all about Medford from its very beginning Of course their troop leader helped them On Medford's fields their leader showed them scars that had been made many centuries ago by a glacier The Brownies visited colonial homes and forts and the site of an old Indian settlement They climbed over a wall that had been built by slaves They called upon the old folks of Medford who liked to tell them about days gone by

The Brownies made notes and drawings of what they heard read or saw during their many travels about town Then they put them in book form and gave their book to the children's library It was the only history of Medford on the shelves and it became one of the most popular volumes in the library

Like these Brownies millions of American girls want to have fun and good times and to be useful too Many have found all of these things by joining the Girl Scouts Almost 500 000 girls have joined the Scouts since Pearl Harbor



These Brownies help Mother with the baking.

By the time Japan surrendered Girl Scouts in the United States had rolled up a record of 27 000,000 hours of volunteer service during the war The Brownies the seven to ten year-olds helped in salvage bought war stamps and did odd jobs at home for their mothers The ten to fourteen year old Girl Scouts salvaged materials bought and sold war stamps and helped their communities in doing a great many different kinds of jobs Senior Girl Scouts fifteen to eighteen years old worked on farms and as aides in hospitals nurseries and in all kinds of institutions which needed Scout services

Forest rangers found that Senior Girl Scout Ranger Aides were able assistants in cutting down underbrush and planting trees and vines to combat erosion All Girl Scouts contributed to the Juliette Low World Friendship Fund which is dedicated to the aid of children all over the world

In 1945 thousands of Girl Scouts earned citations from the Treasury Department for the nation wide clipping service they carried on for that agency They aided the Army Nurse Corps in its campaign for more nurses and helped collect clothing for the United Nations Relief and Rehabilitation Administration Older Girl Scouts held many conferences during the year to discuss ways and means of co-operating in building a lasting peace.

Practically every forward looking organization decides upon goals and programs and sets up for itself a plan of work Usually adults make these decisions but in 1945 the entire membership of the Girl Scouts was given an opportunity to produce the organization's plan of work for the next two years By means of a nation wide survey, Brownies Girl Scouts and Senior Girl Scouts made an outline of what they wanted to do They called their plan A Design for Citizenship by American Girls for American Girls It is a plan of work for young American girls from seven to eighteen years old and millions of Girl Scouts are now putting it into practice To all girls who want it it gives a chance to help build a better America



GIRL GUIDES

By **K Nadine Corbett**

THERE is a great world wide sisterhood of girls which stretches like a chain around the world This is the chain of Girl Guiding In some countries it is called Girl Scouting The color of the uniforms is not the same in every country In very warm countries such as Brazil and the West Indies white uniforms are worn In Canada Girl Guides wear the uniforms that you see on the Guide and Brownie in the picture

All of the girls in this huge family have taken the same Promise at their enrollment and have pledged themselves to do their best to keep the same ten point Law In whatever country they may be you will find them camping hiking singing and learning

Did you know that the Girl Guides have younger sisters called Brownies? The Guides are divided into groups according to age Any girl, once she has passed her seventh birthday, may join a Brownie pack and wear a brown uniform with its own badges The Brownies motto is Lend a Hand The Brownies promise is not quite such a big promise as the Guide Promise, because the girls who take it are not so big but it is every bit as important The Brownie of the British Empire promises that she will do her best to do her duty to God and the King and that she will help people every day especially those at home

Brownies like Guides are expected to do one good turn every day but most Brownies do a great many secret good turns They learn to wash the dishes to make milk puddings to thread needles and sew on buttons as well as hundreds of other useful things which older folk do not really expect younger girls to know how to do That is one of the things that are such fun about being a Brownie—they are always learning to give the people at home pleasant surprises At the beginning of the war grownups thought that there was not much that a Brownie-age person could do in the war effort One group of Brownies proved that the grownups were very much mistaken These Brownies went down to their local Red Cross workroom and threaded needles and loaded pin cushions for the ladies who were sewing there.

The big sisters of the Girl Guides are called Rangers and their special job is to prove that all the things they learned as Brownies and Girl Guides really make them more useful citizens The Ranger is usually more than fourteen years old and under the age of twenty She is asked to carry her practical knowledge and the Guide spirit of her Law and Promise out into the wider world She is both an explorer and a pioneer

An explorer or a pioneer must be a brave and resourceful person and so the Ranger must train herself to meet every kind of emergency—the everyday emergencies that happen at home and the ones that are likely to happen in any town or village

Some Rangers prefer to specialize and become Sea Rangers These girls are particularly fond of the water They are organized as the crew of a ship and their Guider is their Skipper They learn to swim and to handle a boat and to know the weather lore that is necessary for navigating

Many Girl Guides when they grow up become leaders of Brownie packs or of Guide or Ranger companies Thus the chain of Guiding spreads not only around the world but also up and down from one generation of Guides and Brownies to others yet to come into its ranks All those who have known the fun and inspiration of Girl Guiding feel for their sister Guides a very real and special friendship

STATESMEN OF THE ALLIED GOVERNMENTS



Vyacheslaf M Molotoff Premier and Foreign Commissar of Russia.



Cordell Hull diplomat and former Secretary of State in America.



Anthony Eden a former Foreign Secretary is a top diplomat in Britain

UNIO Acme I x French I ess and Info ma on



President Charles de Gaulle of France is a soldier and statesman





I t sh I forma on I a h li os N Y

The Crimea Conference at Yalta, in February, saw President Franklin D Roosevelt, Prime Minister Winston Churchill and Marshal Joseph Stalin meet to talk about world affairs. Top diplomats of the three countries surround them here

Dean Virginia C Gilder sleeve was a delegate to the San Francisco parley





Acme Lo rd Ub ra Ke el

Shown at the conclusion of the American British-Canadian atomic bomb conferences in Washington during February are (seated left to right) Prime Minister Clement Attlee President Harry S Truman and Prime Minister Mackenzie King.

China s Generalissimo Chiang Kai-shek leads the Nationalist government.

HISTORY-MAKERS OF WORLD WAR II



Marshall Gregory K Zhukov leader of the First White Russian Army



General Sir Harold Alexander headed the Allied armies in Italy



The American Chief of Staff was General of the Army George C Marshall



Sovfoto British Information U S Signal Corps

General of the Army Dwight D Eisenhower led Allied armies in Europe



General of the Army Henry H Arnold chief of American Army Air Forces.

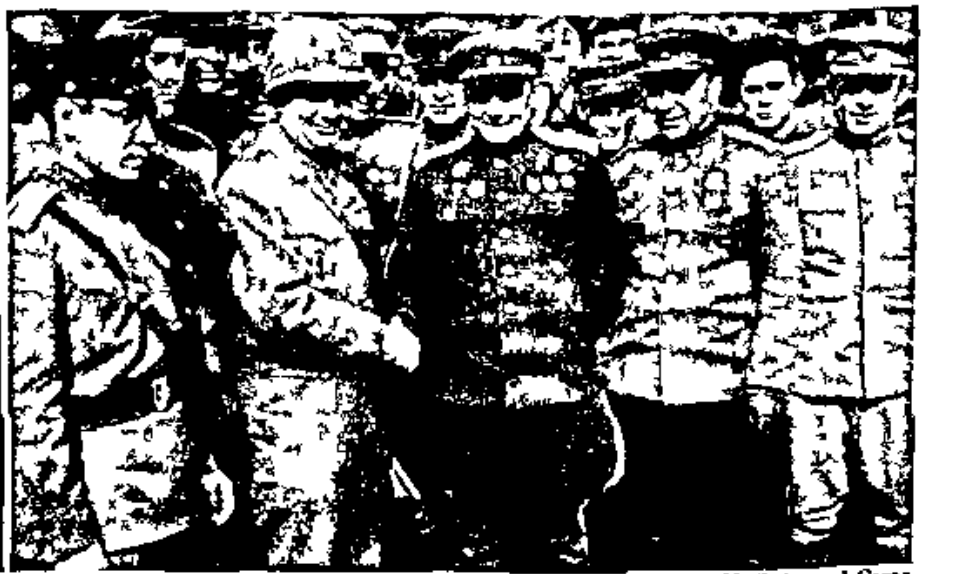


Press Association U S Signal Corps

The unconditional surrender of Germany to the Allies is recorded at Reims, France on May 6 Nazi Chief of Staff Colonel General Gustaf Jodl (center) head of the German delegation puts his signature on the official document.



Canada had a brilliant soldier in Lieutenant General H D G Crerar



Canadian Army U S Signal Corps

The commanding generals of the 69th Infantry Division United States First Army and the Russian 58th Infantry Division shake hands after the history making link up of their forces at the Elbe River in Germany during April.

SOLDIER AND SCIENTIST SHARE VICTORY



Sovfo o

Marshal A. M Vasilevsky of the Soviet Union an outstanding army leader



Press Assoc at on

Troops of the American Marine Corps raise the Stars and Stripes at the summit of Mount Suri bachi on Iwo Jima, in the Volcano Islands



Brt I Informa on

F eld Ma shal Sir Ber nard Montgomery one of England s top generals.



U S A my

General Omar N Bradley commanded the Allied *Twelfth Army Group*



Sc ence Ser ce

Professor Harold C Ur ey atomic expert from Columbia University

U S. S gnal Corps

Major General Leslie R Groves director of the atom bomb development.



U S S gnal Corps

Colorful General Geo ge S Patton Jr led the United States Third Army



I ress Assoc s on

Dr Lise Meitner Ger man Jewish physicist and expe t on atomic theory



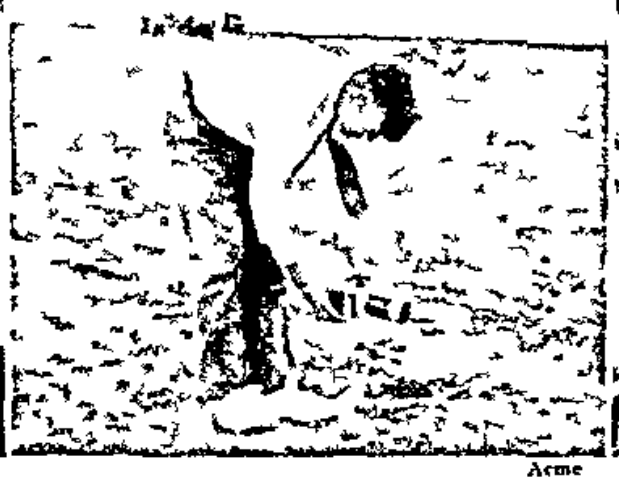
Science Serv e

Doctor Enrico Fermi who made important contribu tions to atomic research.



\rme

Doctor J Robert Oppen heimer a noted authority on atomic physics.



Acme

A scientist measures with a Roentgenometer the rad oac ivity left in the sand by the blast of the first atom bomb near Alamogordo New Mexico.



Sc en e Serv e

Doctor Niels H D Bohr Danish scientist associ ated with the atom bomb

JUSTICE OVERTOOK THE AXIS IN 1945



A me

During the happy days of the German Italian alliance Ben to Mussolini and Adolf H tler rev ew a parade in Rome Present, too a e King Vi tor Emmanuel and Queen E ena wi h high Axis leade s in the ba kground.



A me

Hermann Go ng the numbe two Nazi was head of the air force



U S S gnal Corps

Fie d Ma shal Wi helm Ke tel s gns the ratified surrender terms at Russian headquarters in Berlin



A me

He nri h Himm er was leader of be German secret police.



Pierre Laval, a former premier was exe uted as a traitor to F an e



Former Premier of Japan Hideki Tojo o de ed the attack on Pea l Harbor



Empe or H oh o ru er of Japan is no longef god o the peop e



Fren h Press and Informa on Serv ce Acme Ro si Norw g an Informa on Se vi e

V dkun Quisling was shot for betraying Norway to the German invade s.

A CAREER *AS AN* INVENTOR

By Willy Ley

Rocket-Research Engineer

Washington Institute of Technology, Inc



ONE day about eighty years ago a clerk in the United States Patent Office told his superior that he wanted to resign Asked why, he replied that he was going to find himself another job before he grew too old As far as his job at the Patent Office went, he expected to be fired soon, because there was nothing left to invent

It is not known whether this careful gentleman lived long enough to see the inventions of the electric light, the telephone the automobile, the electric streetcar, the bus, the refrigerator, the airplane, the movie and the radio As a matter of fact, more patents were issued during the thirty years following this gentleman's resignation than during all the time the United States Patent Office existed before that Countless inventions have been made since then Many men became famous just because of their inventions Thomas Alva Edison, the Wright brothers, Glenn Curtiss, Glenn Martin, Igor Sikorsky and Count Zeppelin are known to everybody interested in engineering and inventions

So you would like to become a famous inventor, too?

Well, it is possible, but it is no longer easy

The inventor of today and the inventor of yesterday have little in common The inventor of today is a highly trained professional man, usually called by the title of "research engineer," usually with a Ph D or D Sc. after his name, who works in his chosen field of science or industry But this inventor does not necessarily set out to make inventions Sometimes he just happens to come across them in the course of his regular work

The inventor of yesterday was a different type. He was out to make inventions He was what my friend George O Smith (who is a research engineer in electronics) calls by the name of Garret Genius Garret Genius used to putter around in his home-made workshop, trying to make whatever seemed to offer the greatest rewards in fame and money At one time Garret Genius would work furiously on an electric clock, later airplane engines and airplanes would fill his mind, then it was radio Even today there are still some Garret Geniuses, and you may find them trying to produce jet propulsion motors or rockets

Garret Genius, as a rule was unsuccessful even fifty years ago, and had to have a job such as bookkeeper or sales clerk to keep himself alive Every once in a while Garret Genius did make a useful invention It is said, for example, that the ordinary safety pin is the result of such puttering But such successes were rare Industrially, Garret Genius almost never amounted to much When he did, it was generally in new fields, such as, for a while—radio The really successful Garret Genius who turned out one revolutionary invention after another never existed at all He was only written about in books of fiction

All this does not mean that an outsider can not make money on minor inventions I know a man, in fact several of them, who have from time to time made fair amounts of pocket money from children's toys These inventions were, of course, not really "inven-

WE KNOW THESE MEN BY THEIR DEEDS



...sh Information
Allied leader in south east Asia was Admiral Lord Louis Mountbatten



U S Signal Corps
General of the Army Douglas MacArthur signs as the Supreme Allied Commander during the formal Japanese surrender ceremonies in August



Official U S Navy Photo
Fleet Admiral Ernest J King was the Chief of Naval Operations.



...al U S Navy Ph
Fleet Admiral Chester W Nimitz led Allied naval forces against Japan



...ficial U S Navy Photo
A colorful and daring fleet commander Admiral William F Halsey Jr



...tralian Official Photo
General Sir Thomas A Blamey a top leader of the Australian army



...Canadian Army
Colonel S Moore Congrave signed for Canada at Japan s surrender



U S Signal Corps
General Joseph W Stilwell fought Japan in China India and Burma.



USAAF Photo
Major General Claire L Chennault beat the Japanese air force in China.



Wide World Photo by Sgt T D Tarnett Jr U S Marine Corps
Ernie Pyle beloved columnist and friend of GIs everywhere shares cigarettes with Marine buddies on Okinawa. He was later killed at the front.

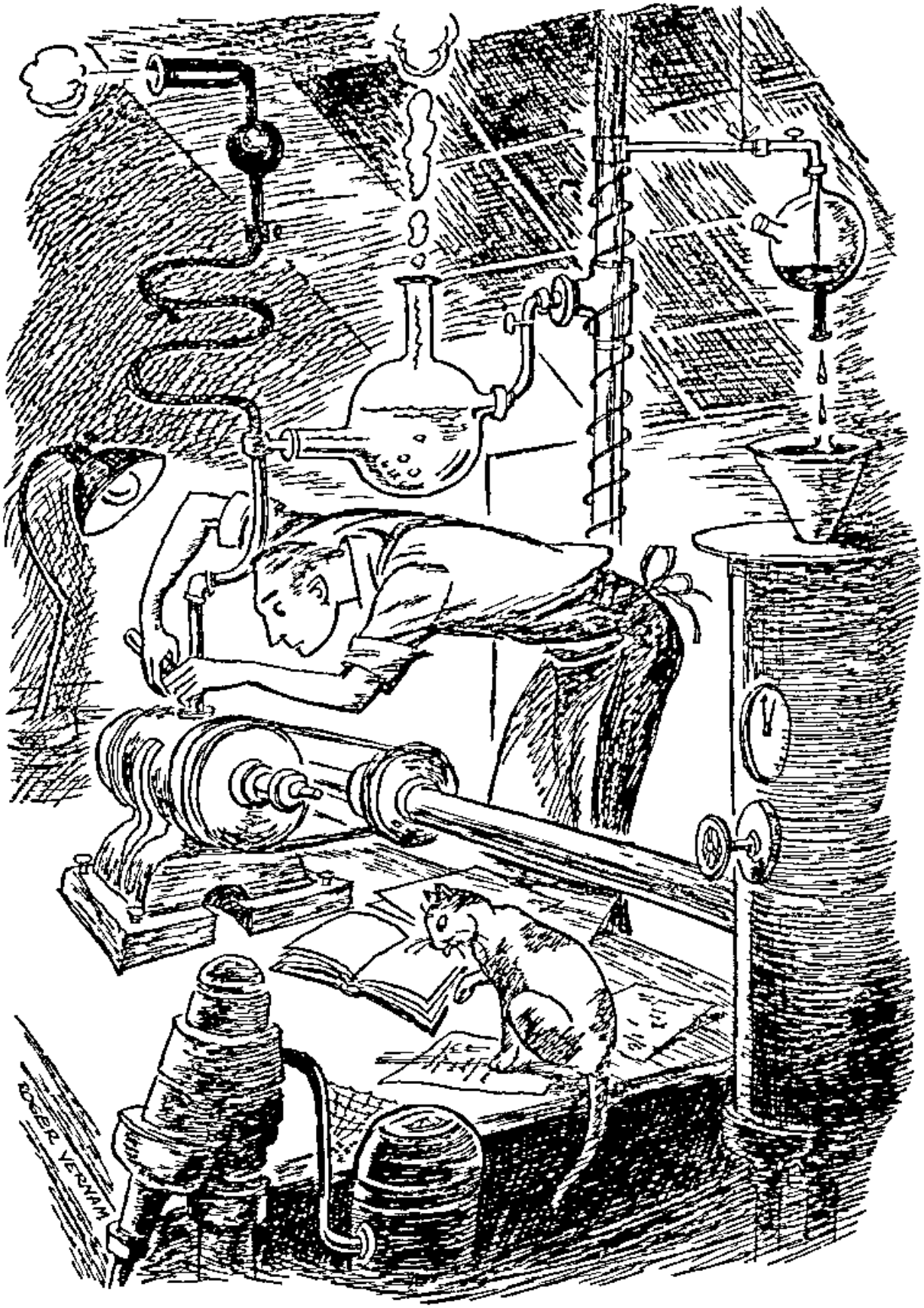


Lieutenant General James H. Doolittle led planes on the first Tokyo raid



General A. A. Vandegrift commander of the United States Marines.

TOIL AND TROUBLE AT MIDNIGHT!



tions but just ingenious and amusing little contraptions And the men who made them were not relying on such income but were mechanics or artists. One was an editor Just as a *side line and In simple little things* there is still a place for the tinkering and puttering that Garret Genius loved

AN INVENTOR MUST KNOW WHAT IS NEEDED IN A SPECIAL FIELD

But as a full fledged inventor Garret Genius has no future and no chance Let us look at the reasons for this The hit and miss tinkerer is out of the running partly because of the amount of money he would need for equipment and partly because he simply does not know what inventions are needed and what would be useful

In the electrical industry for example it was a big problem for some time to make brushes (for electric motors) which would not spark An inventor not acquainted with the electric industry would not have known that this was what the industry wanted He might not even have known that electric motors have things called brushes

Many inventions have depended on highly specialized training For instance, the first batch of the chemical which was developed into nylon was of such a nature that nobody but a professional chemist would have recognized its possible usefulness.

These examples show the reasons why the inventor of today has to be a professional man actively engaged in his field Only when working in the field can he tell what is needed, and only when he is trained can he judge what will or will not be useful

LONG SCIENTIFIC TRAINING IS NECESSARY

The first step for a coming inventor is *simply to make up his mind which field is* going to interest him It might be aviation, or electronics or applied biology or chemistry or atomic physics—you can make a list five pages long The next step, after a field has been chosen, is to get all the training you can in this particular field Such training will often extend into neighboring fields A chemist, for example, who is interested in dyes will also have to know a lot about textiles, medicine, bacteriology and other fields where dyestuffs are used An aviation engineer has to know meteorology, and so on It often happens that a man who received his main training for one field will later change over to a neighboring field with great success The point is that he could not have changed over to a different field, and have been successful in it, if he had not had thorough scientific training to begin with

Equipment and research facilities are problems all by themselves Let us imagine an inventor of the old Garret Genius type, and say that he wants to familiarize himself with everything known about a field which interests him Most of the time this would be difficult for him to do, but it is not impossible Suppose the field picked by this inventor is that of rocket research It is a comparatively new field, and Garret might succeed in reading everything, or almost everything, that has been written about it, which he can do if he lives in a large city with a large and fairly complete library

KNOWLEDGE OF SEVERAL LANGUAGES HELPS IN RESEARCH

Stumbling block No 1 appears right at the outset Garret Genius, in order to read everything of importance written about rockets will have to be able to read German and Russian as well as English, and it would be useful if he could read French also But we'll imagine that he has friends who are willing and able to help him with any translating he needs

So now he has studied most of the existing literature and that has provided him with a general knowledge of what has been done and what should be done next

Because I want to show how certain problems have been solved in the meantime, we'll say that he did his reading in 1939 At that time he would have known that in the field of rocket research there were two problems promising glory, or at least, a very good job to the men who found the answers One of these problems was a good projectile rocket *which could be used as field artillery* The other was (and still is) a rocket which would carry self registering meteorological instruments to high altitudes of 60,000 feet or more

Suppose he tried to tackle the military problem first, wondering why such projectile rockets did not exist He would delve into the methods of manufacture and find out that they were made by compressing a special mixture of gunpowder into cylinders. They also had to have a specially shaped hole in the center But that was a separate problem, and not too important, because such a hole could always be bored out afterward Then, if the experts knew so well what to do, why didn't they go ahead and make

SURPRISE! SURPRISE! FOR GARRET GENIUS!



projectile rockets in quantities? After further study Garret Genius would find out that they did not make the rockets because these rockets were dangerous If such a rocket were dropped by mistake, the brittle cylinder of gunpowder would crack, and a cracked rocket would explode violently when ignited

After thinking things over for some time our would be inventor would emerge with the decision that it would be necessary to invent a powder mixture which could be compressed without becoming brittle

If he were a wise man he would decide then and there that the thing to do was give up To invent a gunpowder mixture with such special qualities was obviously a job for chemists If he did not give up, if he tried hit and miss experimentation in the hope of finding the answer experimentally and accidentally, there was a wide choice of possibilities of what might happen to him The best of them was a visit from an FBI man asking politely what he did with the explosives he tried to buy, and advising him to stop research along such lines The worst of the possibilities was that Garret might blow his own head off

But we have already decided that he was a wise man, and that he left military rockets to government arsenals and expert chemists who, incidentally, did solve the problem by evolving entirely new types of powder

DRAWINGS AND CALCULATIONS ARE MADE FIRST

So, Garret Genius concentrated on the meteorological or instrument-carrying rockets Following suggestions made in the books and articles which he read, he decided to use gasoline as a fuel and to burn it with liquid oxygen Then he had to make a preliminary design, which means making a lot of drawings and making a lot of calculations before the drawings could be made The tanks for the fuel and for the oxygen presented little trouble All he had to do was decide, on the basis of tedious, long calculations, how large they should be Otherwise it was simply a question of getting the proper type of aluminum tubing and of welding it shut at both ends

The rocket motor (where the fuel is actually burned) proved much more difficult At first it seemed that the inventor had only to make up his mind whether it should be a cooled motor or an uncooled motor Suppose he decided in favor of uncooled motors —because it appeared that they were easier to make Then he would have the problem of the exhaust nozzle Here the inventor would be stumped for the first time The shape of the nozzle, which is very important, would need a detailed calculation which has to be made by a specialized variety of professional engineer

Garret Genius has his choice he can attend college for a year or two (which he had not done before, deciding to become a great inventor instead) and acquire enough mathematics and physics to make the calculation himself Or, he can find an engineer or an engineering firm to make the calculation for him and pay a fat fee

Garret Genius, in order to save time, sighs and pays the fat fee, entering into his books the first financial setback of $300 or so (Cheap, too!) After that he goes to work, doing everything himself—after all he does not wish to share the glory with a half dozen other people

ANOTHER EXPENSE—FOR THE NECESSARY TOOLS

He begins with an outlay of about $100 for hand tools, various kinds of hammers, files, pliers, screwdrivers and wrenches Now he cuts his aluminum tubing to proper lengths and cuts and files the covers from sheet aluminum Now the covers have to be welded on, and the question comes up whether he should give this welding job to a commercial welding shop and pay around $30 for the work or whether he should buy a welding outfit He is lucky enough to find a welding outfit at a bargain, and pays about $150 for it Not being too good a welder he ruins his first set of tanks and covers and gives the work to a commercial welding shop after all However, while the work is being done, he watches and picks up a few tricks of the trade

The machining of the rocket motor is the next step Garret Genius buys the raw material—let us say Monel K This metal comes close to a dollar a pound and sets him back another $80, since he buys material for several rocket motors Now he needs a lathe Fortunately he can pick one up for $100 For only $15 or so he can get it brought to his basement, where he has had to move, because the stuff is getting too heavy for the garret Of course, the lathe does not come equipped with the type of cutting tools which he needs, but they can be bought for $30

The next eight weeks go by with a hard and persistent, but not always successful,



Courtesy Carneg e-Ill no s Steel Corpora on

Blast furnaces at night, piercing the darkness with their dazzling glow present an unforgettable spectacle

MAKING IRON AND STEEL

THE WONDERFUL SIGHT IN THE GREAT FURNACES

AMONG the most commonly used materials in our world are iron, and steel, which is a specially treated kind of iron Ships bridges, railroad locomotives, cars and rails the skeletons of great buildings, automobile bodies, machinery of many kinds, tools and household equipment are generally made of iron and steel (though lighter metals are also widely used for some of these things) Iron and some kinds of steel are easily magnetized, and magnets are needed in making dynamos and other sources of electrical power Therefore iron and steel are important in the electrical world

Iron is one of the ninety two basic elements of which the world is made. As you know, some of these elements are metals. Gold, silver, copper, tin, zinc, lead and so on, are metallic elements, and iron is another

Iron is almost never found in the pure, or metallic, state although meteorites of iron containing small amounts of nickel have been found It is generally found in an ore. That means that when the iron of the earth was still in the hot gaseous, or molten (melted), state it formed compounds with other elements—almost always with oxygen To get pure iron therefore, man has to drive out the oxygen. This step is called reduction of the ore

Carbon will take the oxygen out of iron ore at fairly high temperatures The oxygen will fly from its combination with iron and form new compounds with the carbon Charcoal (partly burned wood) and coke (partly burned soft coal) are composed chiefly of carbon, so when iron ore and charcoal (or coke) are placed together in a furnace, and heated to the proper temperature, oxygen and carbon combine and rise as gas while the iron sinks to the bottom as a molten metal This operation is called smelting, and the product is pig iron That, in short, is the main principle of the great iron industry, but to improve the properties of iron in order to make it more useful, other processes are necessary, as we shall see

In ancient times a simple pit was used instead of a furnace. A crude form of bellows made from skins furnished a blast of air strong enough to increase the heat until the metal melted. Low walls of clay surrounding

struggle with machining operations As a rule the would be inventor will give up at some time during those eight weeks but we'll assume that our friend Garret is a persistent character and keeps on struggling The next step is that certain holes have to be drilled Garret Genius who has become Basement Bachelor has bought himself a beautiful electric hand drill in anticipation of this work Unfortunately nobody's hands are steady and strong enough to hold a hand drill for this operation Reluctantly the $50 drill is put away on the shelf and Basement Bachelor orders a drill press It costs about $150 but it is a nice sturdy and accurate drill press Future troubles will be provided by fittings gauges and valves and Basement Bachelor will worry about them later Right now he begins assembly That is fun and easy but he discovers that he forgot about the necessity of testing his rocket motor

TESTING TAKES MORE TIME AND MONEY

Two weeks of making drawings for a test stand are the next step They are followed by six weeks of corrections and additions However these eight weeks do not cost too much money because paper is cheap

At the end of this period Basement Bachelor orders material for the test stand—a lot of angle iron for the framework ($30) half a dozen gauges to measure pressures at various points (another $30) and miscellaneous material amounting to about $100

When cutting his angle iron to proper length for the test stand Basement Bachelor suddenly finds out that a hacksaw is not as accurate as it should be He finds somebody who knows about these things and explains his problem The answer is that if the work is to be accurate and good looking the pieces should be cut a fraction of an inch too long at either end and then trimmed down to accurate size with a milling machine Milling machines can be had from $90 up

BASEMENT BACHELOR STILL HAS NOT MADE AN INVENTION

By now our friend has spent some $1,200 and still has not accomplished what he set out to do He finds that many of the parts he made have to be done over for his workmanship was not what it should have been Now, even if everything he did had been perfect, he would still be very far from having made an invention So far, he has only duplicated what others had done before him in order to have the necessary equipment for beginning work on inventions of his own

But he does have the beginnings of a nice little machine shop, and if he is wise he'll hire himself a professional machinist and go into business

TODAY'S INVENTIONS ARE THE RESULT OF TEAM WORK

If he had been a research engineer to begin with things would have looked a lot different Not only would he have avoided Basement Bachelor's mistakes he would have known in many cases, what to expect He would have known where to find specialized information (Basement Bachelor did not even reach that point) He would have had a fully equipped laboratory or machine shop either of a commercial firm or of a scientific institution, at his disposal He would have had the services of trained men who know how to handle the equipment If he did not have these things usually called facilities, at his disposal he would not have started Most important of all he would have known that team work is what really produces results

That conditions were sometimes (and *only* sometimes) different in the past, does not change matters It is true that some very important discoveries have been made by a few people working alone and working with primitive means Radium was discovered by scientists of the highest training and ability working in a laboratory so primitive that the German chemist Ostwald called it a cross between a horse stable and a potato cellar But such fundamental discoveries are rare and because they are so rare they are written up in books The much more fruitful routine work is too dull to make a good story

Most of the work of inventing grows out of changing or improving upon standard practices or the work of others But in order to improve you have to know the standard practices first, and you have to be thoroughly familiar with what the others have done And don't think that something has to be simple just because it is new Atomic physics was a very new field at the beginning of the present war, but getting a usable result the atomic bomb, required one of the biggest industrial organizations of all history

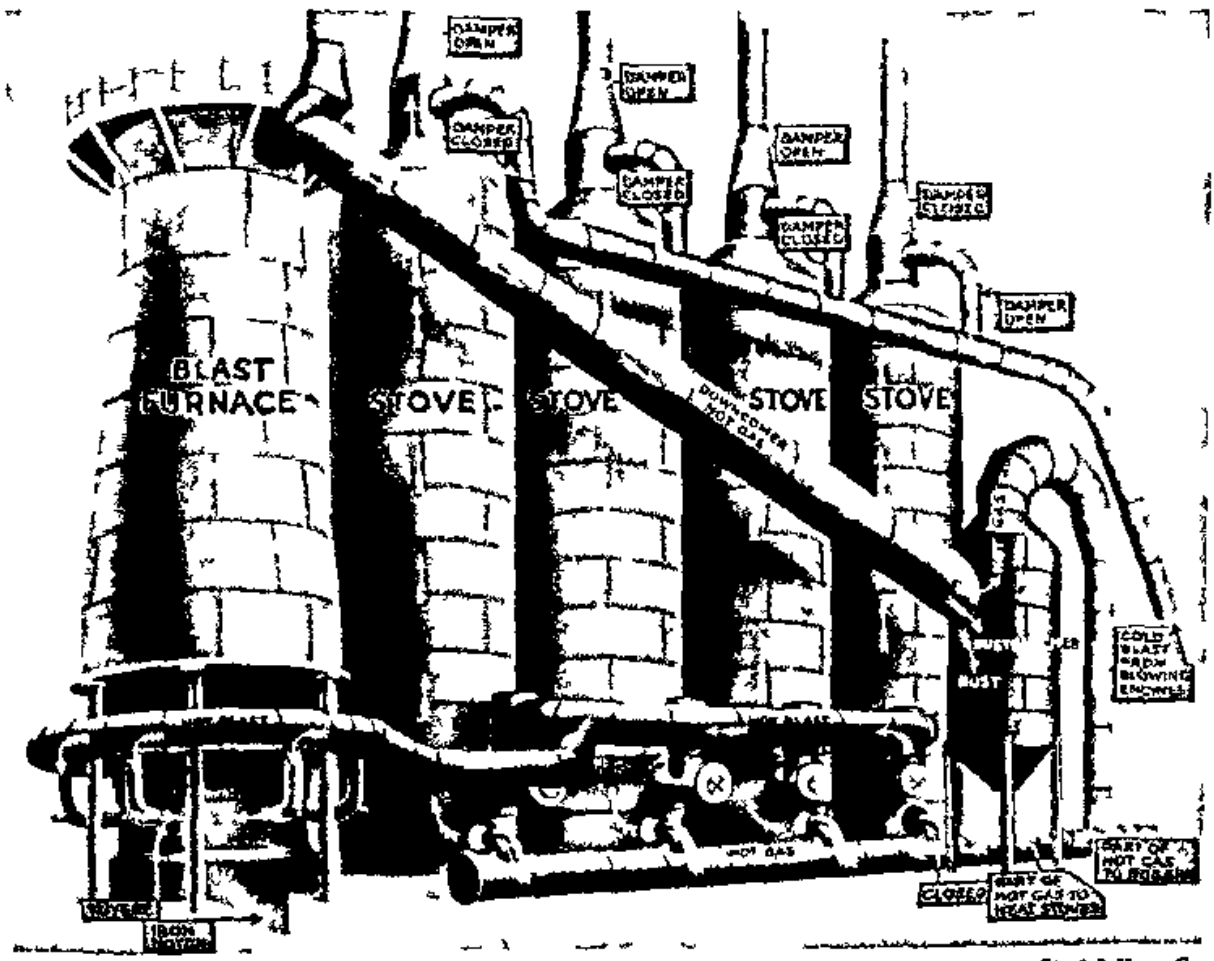
Countless new inventions still have to be made. There is still unlimited opportunity for fame and glory But the new inventions can no longer be made in the basement and the inventor nowadays has to be either a professional engineer or a fully trained scientist before he can even begin

way through the mass. The coal could not burn fast enough to produce a high enough temperature during the smelting process. However, during the experiments it was observed that much of the coal that was heated burned into coke. This coke showed the power to hold up the ore without being crushed, the very thing that coal was unable to do. From that time coke was the fuel, and remains the fuel today, for smelting ores. In the United States the use of coke became general about 1880, some fifty years after England had adopted it.

Iron ore is found in many parts of the world. Some of it is secured from deep mines, but there are places where it is so near the surface that, after the top crust of earth is removed, the ore can be scooped out. The greatest iron ore region in this continent lies near the shores of Lake Superior. One of the pictures in this article shows an open pit iron mine in Minnesota. One can see how readily the soft red ore can be taken from the open pit by steam shovels and deposited at once in the cars. These pits are three hundred feet deep in some places.

One would naturally expect the iron industry to be placed near the pits, but this is not always the case. Pennsylvania, Ohio, Illinois, New York and the Virginias, where less iron is found, are great iron manufacturing sections, and much iron ore must be shipped to them from ports on the shores of Lake Superior. Alabama is an exception, for there both coal and iron are found close together. Nova Scotia has much iron, but brings most of the coal from Newfoundland.

If you follow the line of the bituminous or soft coal, belt, from which coke is made, you will see that it runs through the region just mentioned. This is called the Appalachian coal belt and is about 800 miles long and about 150 miles wide, and contains within its borders the great centers of the iron and steel industries. In fact, these industries will be found to lie closer to the source of the fuel than to the source of the ore.



Courtesy American Steel & Wire Co.

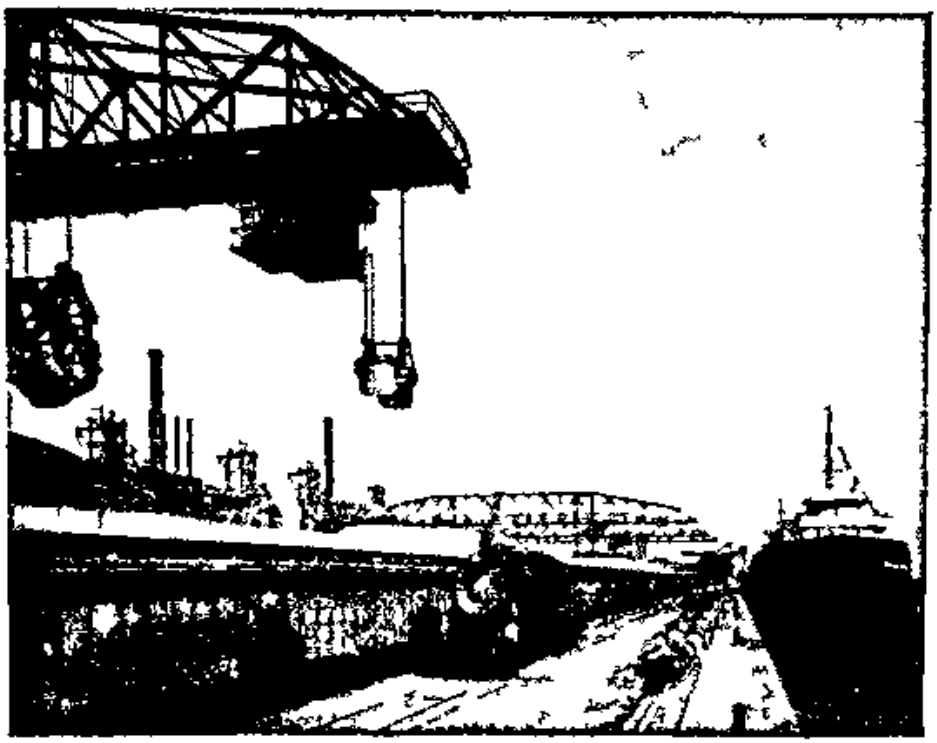
Heating air for a blast furnace. Gas burns in the three stoves on the left, heating the checkers (firebricks). The checkers in the fourth stove are hot. The top damper is closed; the gas is turned off. Cold air is forced through this stove. The air becomes superheated, it is forced through the hot blast pipe into the blast furnace.

the pit were presently added to it and later the pit was done away with altogether The walls of clay became higher and the shaft blast furnace was made In the jungles of Asia and Africa the primitive natives still use such a furnace for making the iron for their spears axes knives and agricultural implements When iron is smelted with low heat it is not like iron from our modern blast furnace where temperatures are high but is soft and malleable that is it can be hammered into various shapes



Open pit iron ore mine in Minnesota Some of the pits reach a depth of 350 feet.

In the year 1622 a little colony of Englishmen built an ironworks on the banks of the Falling River sixty six miles above Jamestown Virginia On the day that the blast furnace was scheduled to go into operation Chief Opechancanough and his braves massacred all of the colonists except one boy who escaped to Jamestown It is probable that preliminary tests were made in the furnace as fragments of slag or cinder were in the ruins But no iron was found Massachusetts was the first colony to produce iron successfully Production began in 1644 on the banks of the Saugus River near the present city of Lynn Later iron production was begun by the people of Connecticut and Rhode Island They and the Massachusetts people used bog and pond ore found in these eastern states.



Boh photos courtesy U S Steel Corporation

Ore for the nation's big steel mills comes down the Great Lakes from Duluth.

Charcoal or burnt wood was the only fuel used at that time There was plenty of wood in America but in England people became alarmed at the rapid destruction of their forests and coal was suggested as a substitute It was tried but it failed because coal was too soft to stand the weight of the iron ore placed upon it The weight packed the coal so tight that the air could not find its

TAPPING THE BLAST FURNACE

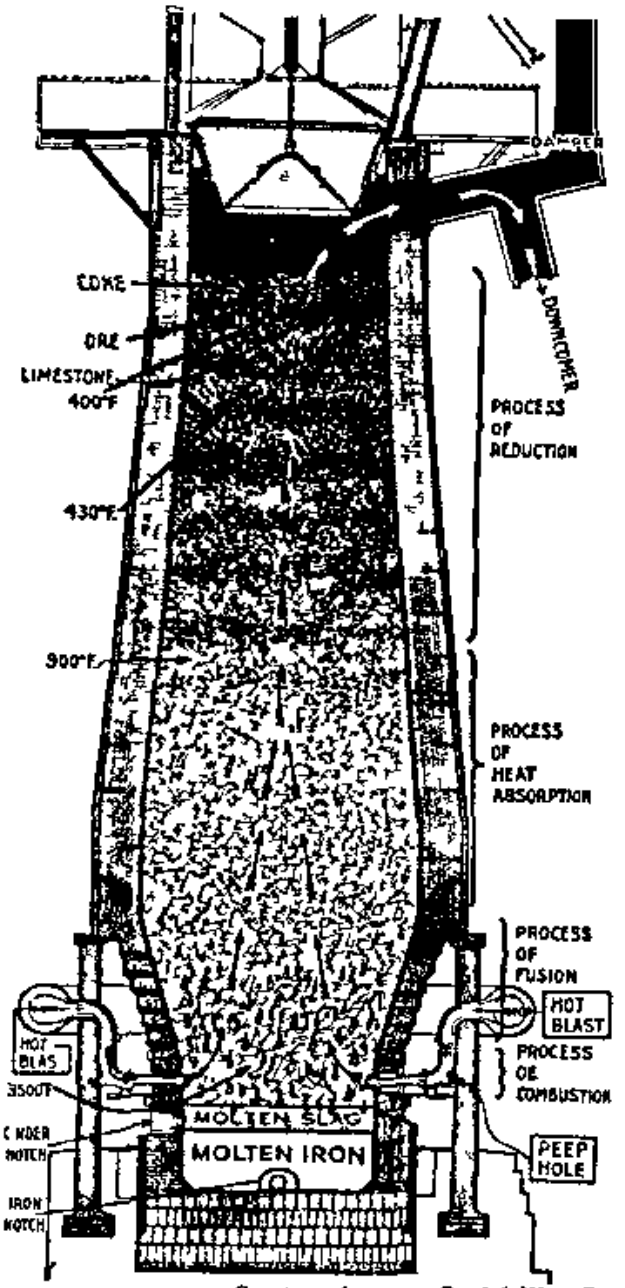


After the fire in a blast furnace is once started, it is kept going continuously, day and night, until the stack needs a new lining or until some other repair is needed possibly three years later In this picture we see the blast furnace being tapped In a picture on a preceding page we saw how the iron ore, coke and limestone are fed into the fiery furnace from the top. The intense heat of the furnace melts the iron and it settles at the bottom. *This molten iron is drawn off from time to time through an opening which is called an iron notch;* it is shown at the right of this picture The molten iron is guided through separate runners, or channels, into ladles When the iron cools it is put through several other processes and then goes to the steel mill where it is made into steel. The impurities in the iron have been cast off in the form of slag (Slag is the scum which is thrown off from molten metal.) This slag, also in molten form floats above the iron in the furnace because it is lighter than iron. *The molten slag is drawn off every two or three hours from the furnace through the cinder notch, seen* at the upper left in the picture, it is the higher of the two tapping holes.

Success in the iron and steel industries is partly due to the making of coke out of coal Coke is simply soft coal heated until the gases are driven off For years the coal was coked in what is called a beehive coke oven The name of the oven was no doubt suggested by its resemblance to the ancient dome shaped beehive The beehive ovens were charged with coal at the top usually while hot enough from the previous charge to ignite the coal put in A small part of the coal burned and the gas that coal contains was driven off to burn at the top of the oven The reason that all of the coal did not burn was that not enough air was allowed to enter the oven

Of course, if gas from coal would burn at the tops of the coke ovens, it would also burn in furnaces and under boilers where it would be useful, so late in the nineteenth century men began to build what are called by prod uct ovens These are very intricate struc tures of firebrick and steel that distill the gas from the coal and not only make more coke per ton of coal, but recover gas, ammonia and tar

At the coke plants are stills, scrubbers, fractionating towers and other apparatus where the most surprising chemicals are separated from the crude tar mixture. There are ammonium sulphate for fertilizer, benzol to mix with automobile gasoline, toluol for explosives, naphthalene to keep the moths away and creosote to preserve railroad ties and telegraph poles Some of the by products are later manufactured by others into even more surprising things plastics for instrument cases and automobile panels and a thousand other articles, saccharine which is at least three hundred times as sweet as sugar, dyes, medi cines and even per fumes



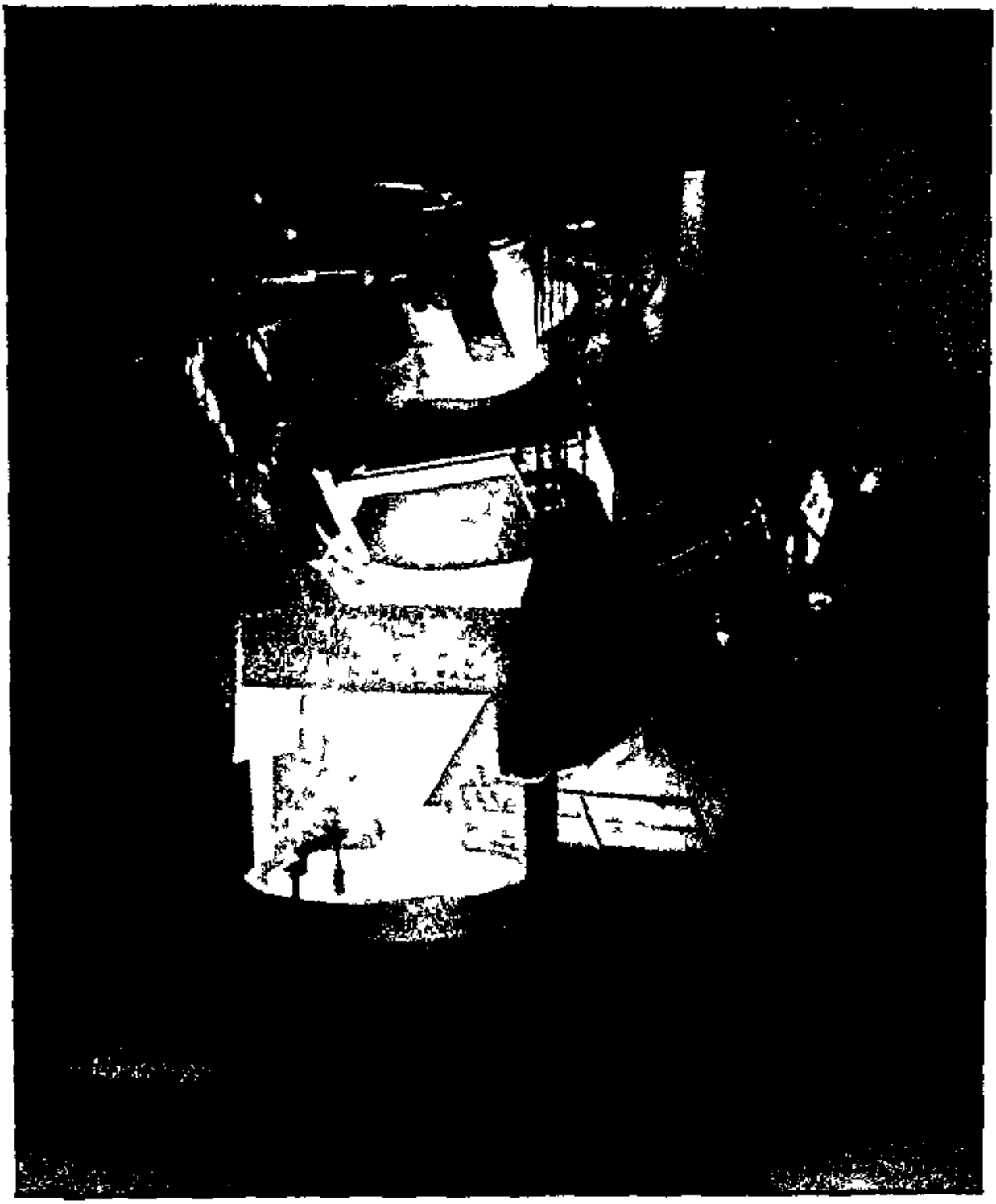
Courtesy Amer can Steel & W re Co

Diagram of a blast furnace stack. Iron ore coke and limestone are fed in alternate layers through the top. Hot blasts from the bottom increase the heat inside the furnace The heat melts the iron in the ore: the molten iron sinks to the bottom and is drawn off through the iron notch. The impurities float as slag above the iron. The molten slag is drawn off through the cinder notch.

The coke produced in the by product ovens is loaded in cars and taken to the blast furnace plants The gas and the tar are used as fuels in making steel, the gas is piped to the mills and the tar is taken there in tank cars. It is interesting to note that, while gas is a by product in the manufacture of coke coke is a by product in the man ufacture of coal gas, made as a fuel for cooking

The blast furnace is the first step in the process of making iron and steel. The shaft blast furnace that we have seen develop from the pit became over the years larger and higher until finally the large amount of charcoal and the in creased blast pro duced a great deal of heat in the furnace The reduction of the ore went on as before, only faster, but when the globules of iron became hotter they absorbed carbon from the charcoal and silicon from the stone-like impurities in the ore. Iron containing these elements is no longer malleable and hard to fuse, but brittle and easily melted Instead of

MAKING ELECTRIC FURNACE STEEL



Certain types of high grade alloy steel are made from steel scrap in electric furnaces, such as the one shown in this picture. The electric furnace holds up to a hundred tons of metal. Huge carbon electrodes, or terminals (*shown at the top of the picture*) are lowered to within a few inches of the charge of scrap and then the electric current is turned on. An electric arc leaps from one carbon electrode to the other passing through the metallic charge below as that is the easiest path, with a deafening crackling sound like that of the motors of a big plane warming up. The width of the air gap between the electrodes and the charge is automatically regulated this is brought about by clever devices which raise or lower the electrodes as the resistance in the current varies. Intense heat is produced it converts the steel scrap and certain alloying materials (such as chromium, nickel and molybdenum) into the finest steel. The metal is poured from the bath by tilting the furnace. In this picture forty tons of stainless steel are being poured. In certain cases the steel is poured from the ladle through a runner or channel which leads to the bottom of a mold instead of being poured directly into the mold itself. The chief advantage of this method of pouring through a runner is that it insures a better surface in the finished steel. This is due to the fact that splashing against the side of the mold is avoided.

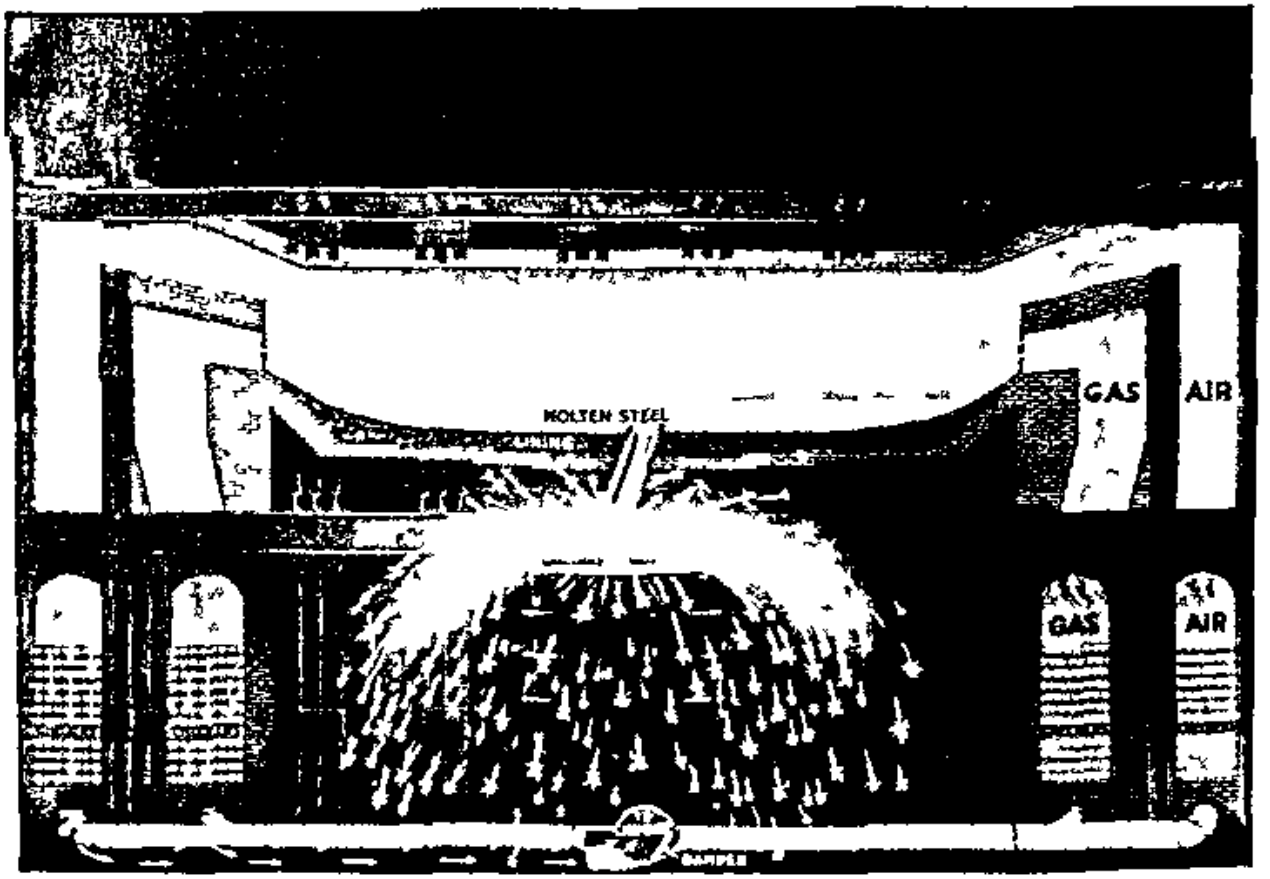


Diagram of an open hearth furnace The charge at the top is the "bath." Burning gas pours over the top of the bath, burning away the impurities in the metal The flow of gas and air is reversed from time to time

being dug out from the furnace in the solid state, it ran out as a stream of hot metal into sand molds. It was called pig iron because molds were formed on each side of a central runner called the sow and the whole was thought to resemble a family of pigs

In the early furnaces it was found that if limestone were added to the ore and fuel in the furnace, the impurities fused with the limestone in a mass called slag, which floats on top of the molten iron This comes about because lime combines easily with silica, the chief impurity in ore

Now the blast furnace receives a layer of coke, a layer of iron ore, a layer of limestone, then one of coke, one of iron ore, and one of limestone, and so on The molten iron sinks to the bottom of the furnace and is tapped, or drawn off at intervals through an opening called the iron notch The slag sinks down and floats on top of the iron Slag is removed at intervals through an opening, called a cinder notch, above the iron tapping hole Everything put in the furnace comes out either molten or as a gas Once lighted a blast furnace remains in blast day and night for several years

The blast furnace has now grown from the little rim of clay around the top of a pit to a stack about one hundred feet high and to a diameter of as much as twenty six feet at the bottom or hearth. The blast furnace and the equipment that goes with it have become a very complicated apparatus Until within the last few years the furnace was sometimes undependable. It might refuse to make iron or it might freeze Sometimes a part would slip and scatter ore dust over the country side Now the engineers have learned to control the operation and such things very rarely happen There was always a little sentiment about a blast furnace Not so long ago they were named for women, often for the wives of the owners The Eliza, Carrie, Lucy and Isabella furnaces have been well known in the industry This practice is dying out

The diagram shows the blast furnace and how it works The men who operate it watch the temperature of the blast, watch the slag watch the quality of the iron, in fact, they watch everything about the furnace

Since the blast furnaces as they grew larger made an iron that was brittle, of course it could not be forged or welded So a new problem was created Some of the iron was cast into pots and other utensils, stoves, firebacks

picks up carbon from the charcoal used for heat and becomes steel of a fair quality If he gets tired of blowing his forge and rests for a little while, the steel absorbs more carbon and becomes harder These processes are the basis of all modern iron and steel making.

It was only a step from the simple process described above to the cementation process of making steel Here bars of iron were packed in charcoal and allowed to stand for quite a long time at red heat The iron absorbed carbon and became steel It was called blister" steel The Damascus and Toledo blades, famous swords of the Crusaders' times, were made in this way Their deserved ly good reputation was due to the skill of the iron workers of those days.

In 1742, Robert Huntsman of Sheffield, England, melted the bars of blister steel made by the cementation method, in small cru cibles By choosing his bars and by additions that were easy to make in a crucible he was able to make a fine steel. The best steels in the world were made by the crucible process until early in this century when the electric furnace was developed Table cutlery, tool steel for cutting wood and metals, knife blades, files surgical instruments and the like were all made by the crucible method Now, because the electric furnace can make just as good steel, and make it cheaper, the crucible process has almost disappeared.

In 1854 Henry Bessemer in England rea soned ' Steel is only cast iron with the impurities removed and a little carbon added. I will burn these impurities out of the molten iron with air " He did so and thus the greatest step in the history of the industry was taken

The modern Bessemer converter is a sort of gigantic pear shaped kettle with the small end, at the top, open It is suspended on trunnions (pivots) about halfway up its height, and can be tipped The bottom is detachable and fitted with tuyeres (air pipes) containing small holes A blast of air is forced through the tuyeres and through the molten metal in the converter, or vessel The oxygen of the air unites with the carbon in the iron and burns away the impurities.

HOW MOLTEN IRON IS CONVERTED INTO STEEL IN A MODERN BESSEMER CONVERTER

A Bessemer converter blowing is one of the most glorious sights in industry The vessel is turned on its side, molten iron is poured into it from a ladle, and then the vessel is tipped upright again with the blast turned on. At first there is a great burst of flame and shooting sparks. Then red brown fumes with dull red pointed flames appear, as manganese and silicon start to burn with the oxygen in the air As the burning of silicon is completed the dull red flame changes to bright yellow tinged with green Now carbon begins to burn with a long yellow white flame It is very spectacular The flame shortens when most of the carbon is burned out. Watching the flame closely through special colored glasses the blower turns down the vessel just at the right moment when the flame wavers and brown fumes of iron oxide appear

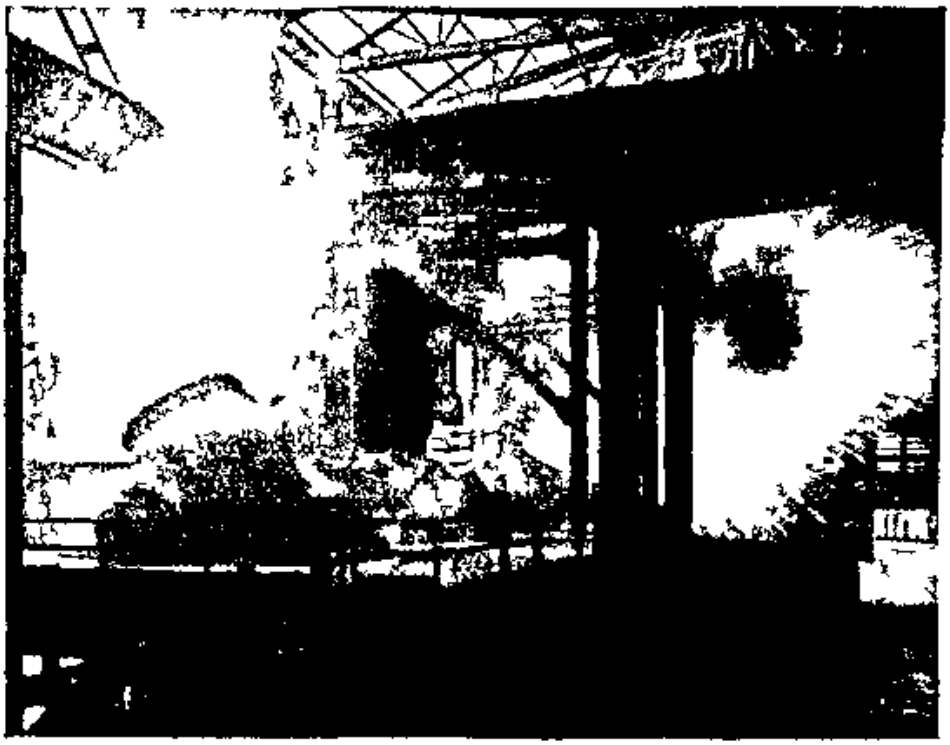
The molten pig iron has been turned into steel The lever man pours the steel into a wait ing ladle The whole blow lasts only twelve or fifteen minutes Meantime another vessel has been receiving its charge of iron and as soon as the first is turned down the second one is turned up and another heat is blowing Too much carbon has been removed so after the ' blow ' a little carbon and other desired materials are added

As you can see, this process is capable of producing thousands of tons of steel where the puddling furnace made only a few hun dred pounds of iron and the crucibles even less of steel Therefore Bessemer steel came to be used extensively for rails at the time when railroads were being built all over the world, for steel ships that soon began to replace those of wood and a little later for steel cars, pipe lines and high buildings.

THE OPEN HEARTH FURNACE HAS ALMOST CROWDED OUT THE BESSEMER PROCESS

The open hearth furnace, though it was in vented about the same time as the Bessemer process, was slower in coming into general use. When it did become established, how ever, it crowded out the Bessemer process until now Bessemer steel is used only for special purposes The open hearth heat takes eight to twelve hours to make, depending upon the size of the furnace, but it can be controlled more easily than the Bessemer and the steel is more suitable for many uses The furnaces are shallow hearths covered with an arched roof with uptakes on each end and checker chambers for heating the air and sometimes the fuel under the charging floor Hot burned gases pass through the checkers at one end of the furnace across the molten iron, for about fifteen minutes, then the valves are reversed and the heated checkers heat the incoming air

The open hearth charge is not only molten iron like the charge of the Bessemer con verter, but steel and iron scrap as well Scrap is metal that has been used and partly worn



The Bessemer process The big bowls containing the charge are called converters

was called wrought iron The puddling furnace has about gone notwithstanding the good qualities of wrought iron that it made It was forced out by the improved steel making processes invented later Wrought iron is produced only on a small scale at the present time Nevertheless it was important in the period before steel became well established Rails bridges, locomotives, car axles pipe and countless smaller articles were made of wrought iron in the nineteenth century

(the back walls of furnaces and fireplaces) and the little machinery used in those days But a method of changing the brittle iron into a malleable form, for wider uses, was needed, and before long it was found

In 1784 Henry Cort invented the puddling furnace for converting pig iron into wrought iron This was a coal heated process Pig iron as it came from the blast furnace was put on the platform or hearth of another furnace The firebox lay at one end instead of underneath as in the blast furnace As the fire grew hotter the burning gases from the coal passed over the mass of pig iron on the hearth. A man called a puddler kept stirring the iron with a long bar As he did so, it gradually became a hot spongy mass filled with liquid slag. The spongy mass was rolled into a ball called a bloom, weighing from 150 to 200 pounds Most of the slag containing silicon carbon and other unwanted elements was squeezed out of the bloom The essentially pure iron that remained was rolled and worked as desired. This

Steel is a rather pure iron hardened by the absorption of carbon After the native mentioned on page 166 obtains his lump of iron from the small blast furnace, he heats it in a forge like a blacksmith's fire to soften it so that he can hammer it into tools The iron

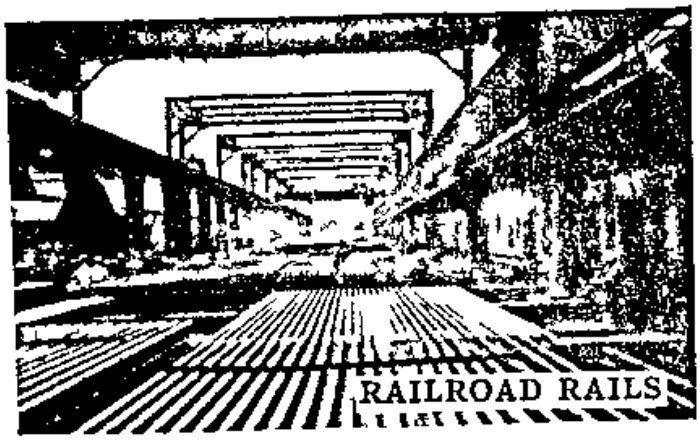


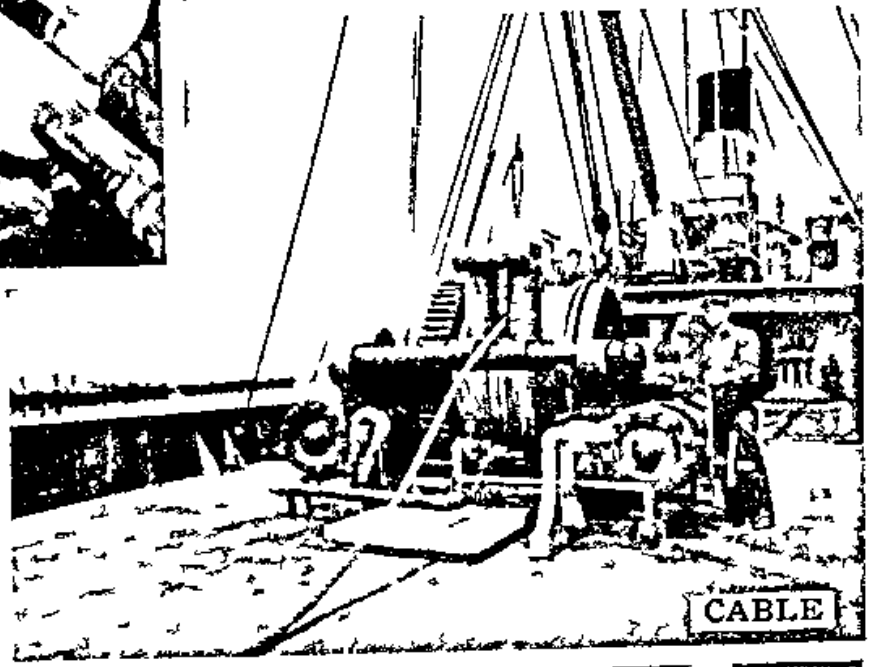
Both photos courtesy U S. Steel Corporation

Here we see the important process of teeming—that is pouring molten steel into an ingot mold. The man in the picture is filling a big spoon with molten steel in order to get a sample for testing purposes.

STEEL IN MANY SHAPES







Center and lower left photos courtesy, Jones & Laughlin Steel Corp other photos, courtesy U S Steel Corp.

It has been said that steel is the 'backbone of the nation', for thousands of steel products are required to meet our present needs Here we see a few of these products

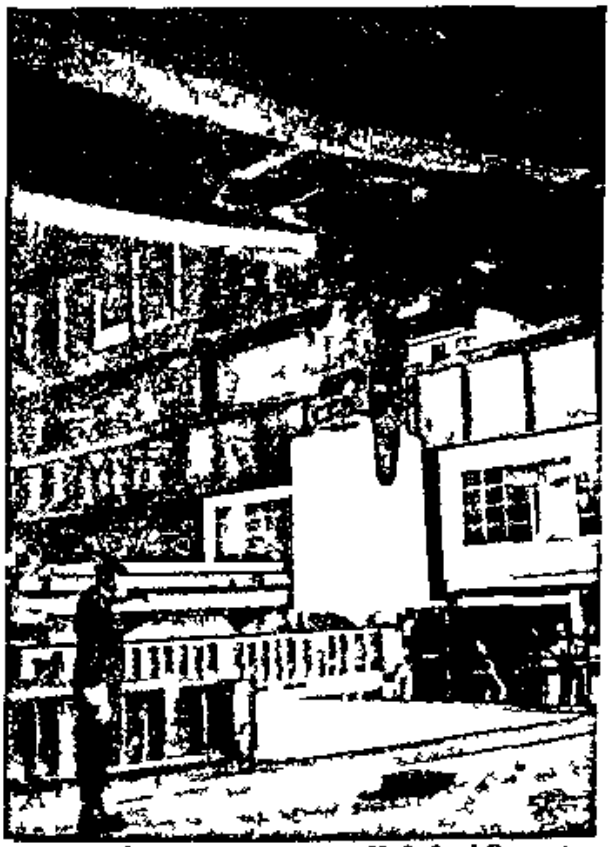




FROM INGOT TO SLAB OF STEEL

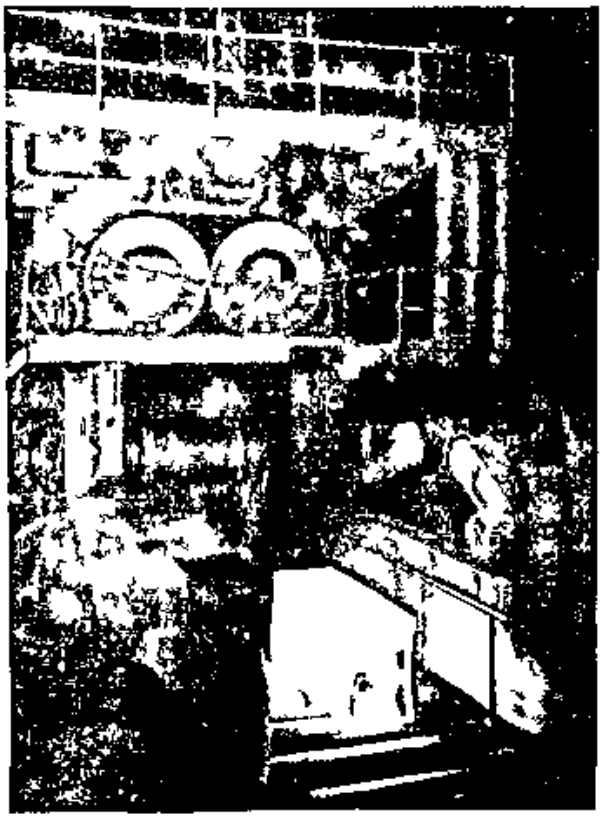


The ingot tra n. Here the molds are stripped from the ingots of steel.

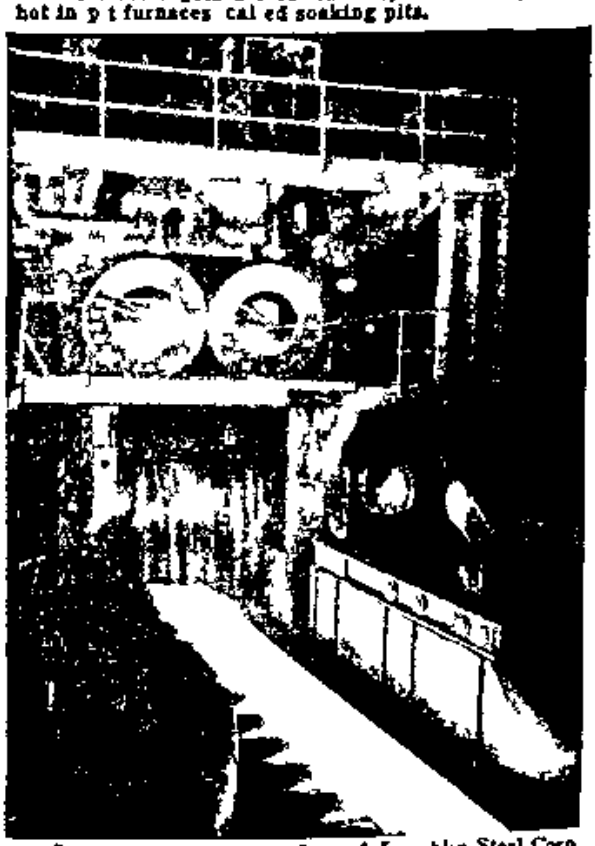


Upper pho os courtesy U S S eel Co poration

Befo e steel ingots a e rolled they are heated white hot in p t furnaces cal ed soaking pits.

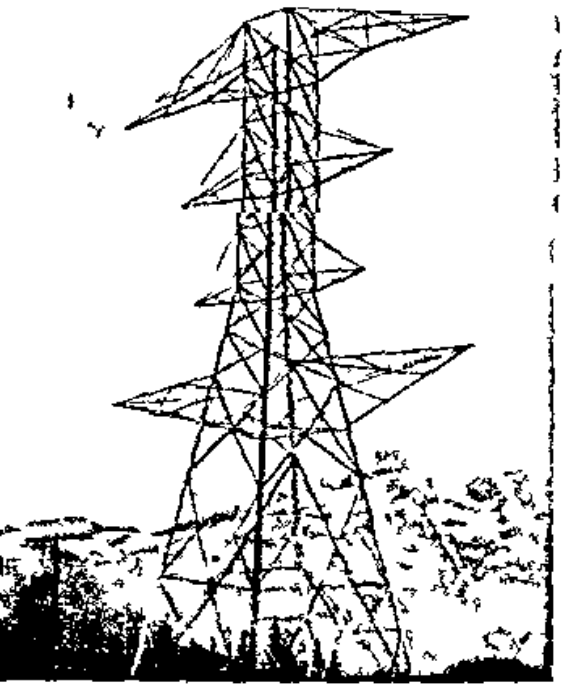


In the blooming mill steel ingots, like that shown above, are rolled into various shapes.

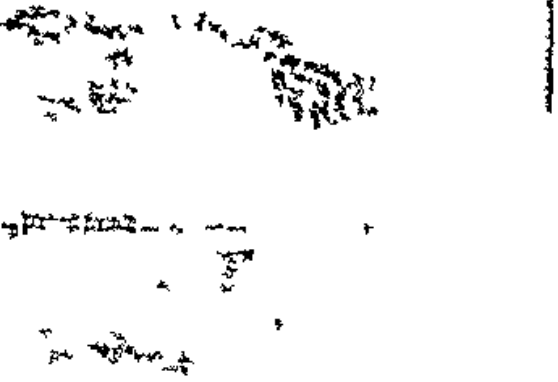


Lower photos, court sy Jones & Laughlin Steel Corp.

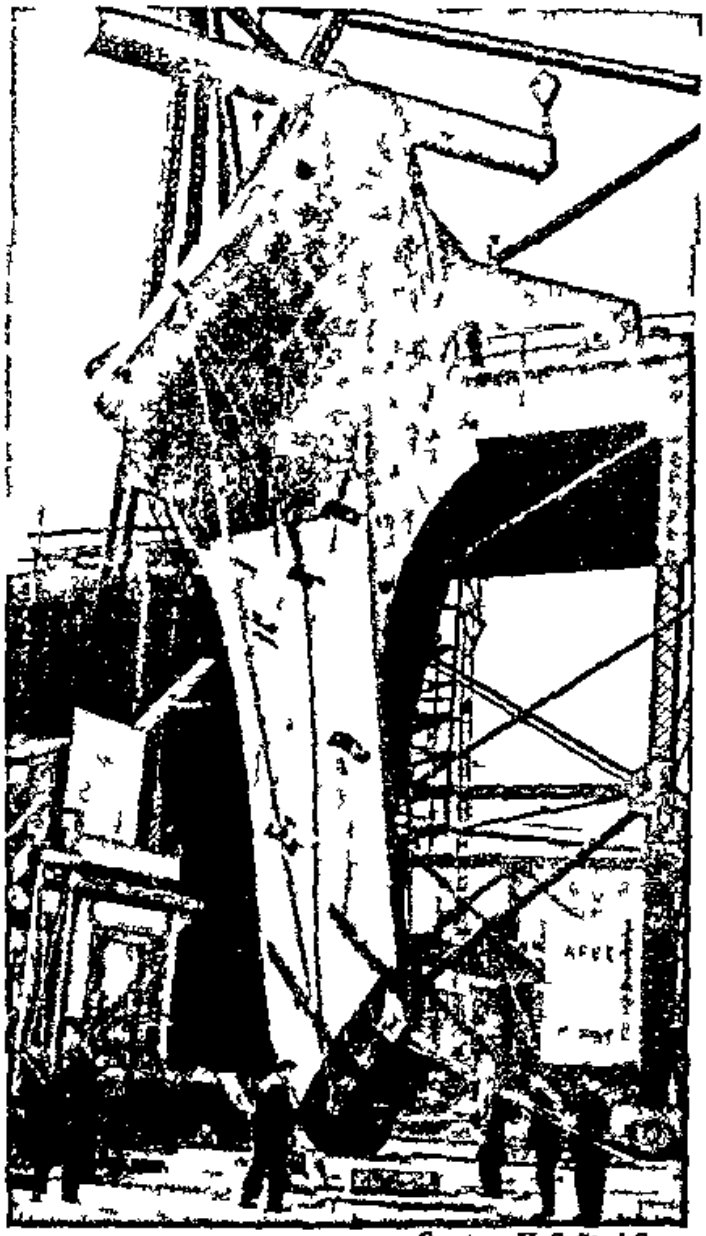
The chunky ingot shown in the picture to the left has now been ol ed into a long s ab of steel



Courtesy American Bridge Company
A transmission tower in the Far West.



Courtesy N Y Central System
most useful and ornamental products of steel.



Courtesy U S. Steel Corp.
Setting in place the prefabricated bow of a ship.

the other electrode As the current crosses the gap of air, from the electrode to the charge, and again on the return journey, sparks are emitted like those of an old fashioned arc lamp The higher grades of tool steel cutlery and stainless and other special alloy steels are made in the electric furnace.

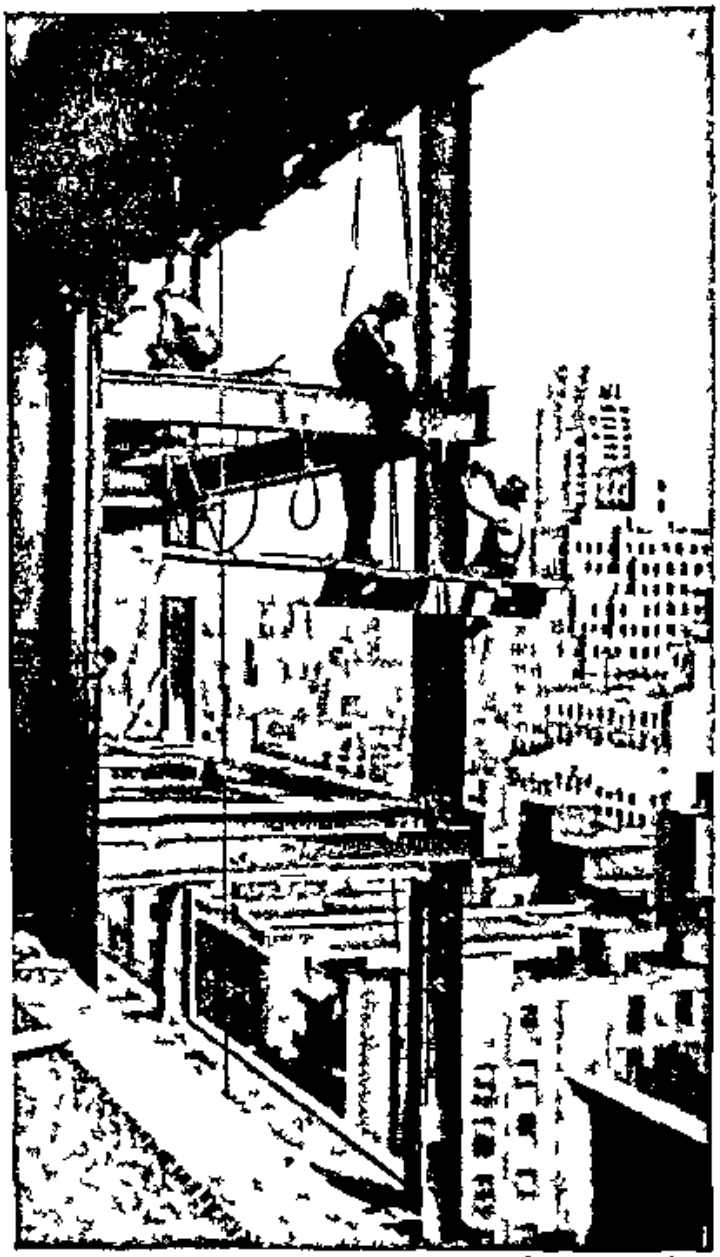
Steel castings are today one of the most important steel products They are used for railroad cars, locomotives, steamships, heavy machinery and artillery Cast steel has almost entirely replaced cast iron.

After the ingot is formed and stripped of its mold it is almost always rolled A very few are forged under a press into heavy armor plate and large shafts.

At the rolling mill all the ingots are re heated. Then they are rolled in a blooming or slabbing mill to blooms billets or slabs Slabs are flat and will be rolled again on plate mills into plates for cars, ships, welded pipe, tanks, barges, or boilers, or on strip mills for tin plate for tin cans, sheets for refrigerators, stoves automobiles and railroad passenger cars Blooms are rolled into shapes for build ings, car frames bridges, ships steel piling and machinery Billets are rolled into rods for drawing into wire bars and small shapes, hoops bands and other things Final prod ucts are made from these steel mill shapes

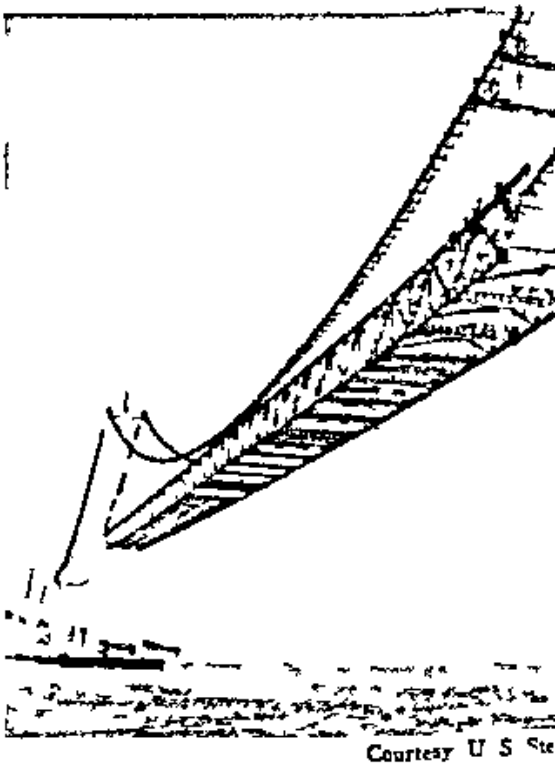
Article prepared with the assistance of John G Mapes, of the American Iron and Steel Institute.

STEEL IS USED IN MANY DIFFERENT WAYS



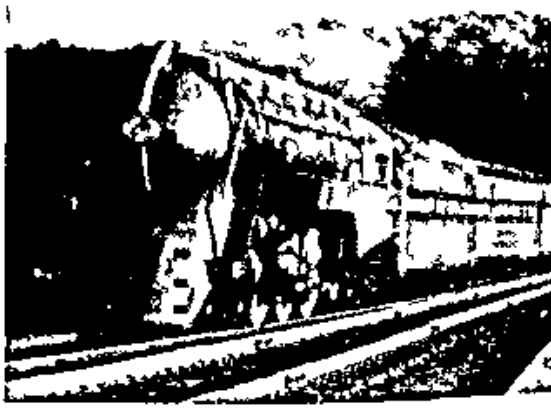
Empire State, Inc.

Fitting in place the steel girder skeleton of a skyscraper.



Courtesy U S Ste

Building a steel suspension bridge.



A modern stream lined train—one of the

out. Buildings with steel skeletons are sometimes torn down to make way for newer buildings, rails and cars are constantly wearing out and all kinds of machinery are being abandoned, either worn out or no longer suitable These are among the sources of iron and steel scrap. The steel mills, too, make steel scrap. It comes from the leftovers when beams, plates and rails are cut to measure.

The open hearth fuel is gas, tar or oil It may be part of the gas which was made at the coke ovens, it may be natural gas which is best of all, or it may have to be made from coal. After it is made the molten steel is poured through the bottom of a ladle into ingot molds It soon solidifies into an ingot shaped by the mold The molds are stripped off and the ingots are hauled to the rolling mills to be made into steel products of a thousand uses Steel for practically every purpose is made in the open hearth furnace except the finer grades of tool steel and stainless steel.

The newest method of making steel is the electric furnace process Here heat is supplied by electric current The Heroult furnace, which is the type most used, is a squat cylinder with a hearth for the steel and adjustable electrodes projecting through the roof When the electrodes are lowered close to the iron in the bath current is sent from one, down through the iron and back up again to

rule, that of himself as emperor Jimmu was thus the first emperor and the first human ancestor of the imperial family

In time, the nation as a whole became organized very closely after the old family pattern The emperor took the place of the family patriarch The goddess of the imperial family took the place of the family god And just as each family member was taught to serve his family god by service to the family, so each Japanese was taught to serve the goddess of the imperial family by serving the nation The emperor, as the living descendant of the Sun Goddess, bound together as a nation a people who considered themselves individually to be the descendants of spirits

All of these beliefs are very, very old In more recent times, the Japanese government has made use of them Since 1868 the government has maintained a cult known as National Shinto Its purpose was to preserve the unity of the nation through the obedience and loyalty of each subject to the emperor This is what National Shinto says

"The protection and the advancement of the country are in the care of the ancestral spirits and their power resides in the emperor"

Stop for a moment to think what that means The emperor, and those who represented him in the government, had absolutely unlimited power over the people Body and soul the Japanese were bound to the emperor's service

But after Japan was conquered in 1945, Japanese thinking began to change At last the emperor himself declared that the idea of his divinity was false

A RELIGION THAT DOES NOT TEACH LOVE, CHARITY OR KINDNESS

Shinto, whether as a religion or as a cult, teaches only the unity of the Japanese people among themselves Love, charity, kindness and many other virtues are neither required nor taught by Shinto What it does require of its believers is that they shall be loyal and obedient to their families and to their rulers. It holds out the promise of good things on this earth, such as bountiful crops, good health and success.

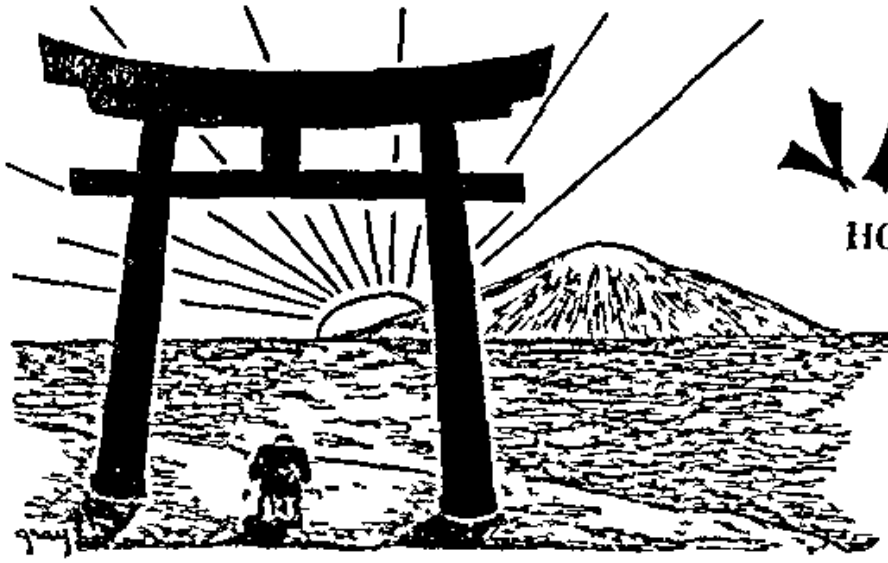
Through the centuries other religions have played their part in molding the Japanese character Chief among these is Buddhism Buddhism is a religion found in all parts of Asia. It first came to Japan by way of Korea in 552 AD About seventy years later, Prince Shotoku, the ruler of Japan, decreed that the government should be placed in the hands of the Buddhist priests He established Buddhist monasteries and temples, a few of which exist to this day From this start grew the first and greatest period of Japanese art Artists, engineers and craftsmen were brought from China and Korea to build magnificent temples, and the making of the sculptures, gold and bronze vessels and the silk fabrics with which the temples were adorned taught the Japanese arts and sciences which they had never before known So it was through Buddhism that the learning and skill of the continent of Asia came to Japan, and changed a nation of tribesmen into a community with an organized government, with its own writing and with a more advanced way of living

TODAY THE JAPANESE RELIGION IS A MINGLING OF SHINTO AND BUDDHISM

Buddhism taught many things which were unknown to Shinto Buddhism taught that good conduct is in itself a good Buddhism held out to the Japanese a way to spiritual life and to happiness in the next world This way of living was called the Eightfold Path and it consisted of right thinking right aims right speech, right deeds, right livelihood right effort, right mindfulness and right meditation But the Japanese were so used to their old laws of loyalty and obedience to their ancestral spirits and to their rulers that they would have none of the new religion and of its strange gods Then a famous priest proclaimed that the gods of Shinto were true Buddhas, that is, perfect beings, and that only their names were different After that the Japanese who had believed in Shinto were willing to believe in Buddhism too So Buddhism took firm hold in Japan and for eight centuries or more, the great religious faith of the Japanese people has been a sort of composite of the two religions

The Japanese have never drawn a sharp line between religion and government In fact, the old Japanese word for government means 'things that have to do with worship' We in America and Europe hold that mankind can not progress if religion is used by government to control the thoughts and actions of men But in Japan, religion has been a tool of government.

The United Nations are now in military occupation of Japan One of their most important and also difficult tasks will be to separate religion from government The Japanese people must be made to realize that the great human race is like a mighty tree, and that you can not injure one branch without injuring the whole tree



JAPAN

HOW THE JAPANESE CAME TO REVERE THEIR EMPEROR

By
Eugene H Dooman

ALL primitive peoples have an explanation for the world about them In most cases this explanation starts with a creator of the world and of everything in it But the primitive Japanese did not think about a creator of the world When they tried to explain the world they thought about the spirits of their ancestors The Japanese looked at their mountains and waterfalls rivers and trees, and thought that these things must be ancestral spirits in forms which could be seen by ordinary mortals

In Japan nearly all the destructive and fearful forces of nature are found There are of course, lightning and thunder Then there are violent storms known as typhoons which are always accompanied by heavy rains that often cause floods Hardly a day passes without an earthquake occurring somewhere in the country And, in addition, there are volcanoes which erupt from time to time with fearful violence It was very hard for a simple folk to understand the sudden appearances of such terrifying and harmful forces

In those early days all the land in Japan was divided among clan like families of hundreds or even thousands of people Each family had a patriarch who had power of life or death over his family The spirit of the first ancestor was the family god Every member of a family was taught that the family god could be served only by service to the family This belief kept each family closely knit together.

When there were floods or earthquakes or the eruption of a volcano, the early Japanese thought that the family god was punishing the family In the course of time it came about that each aspect of nature, both good and bad, was thought to be some spirit or god One spirit might appear to man as a mountain Another spirit might appear as a tree This nature worship was known as Kannagara which means All that exists is spirit Later it was called Shinto, which means the Way of the Gods."

The first history of the Japanese, the *Kojiki* tells us about the first ancestress of the Japanese imperial family She was the goddess of the sun Her name was Amaterasu o mikami which means 'the Great and August Spirit who Illumines the Heavens" And this is her story She had a brother, Susano-o, the god of storms He was mean and mischievous He took delight in teasing and mistreating his sister One time, the god of storms was so unkind that the goddess of the sun who was a gentle spirit, concealed herself in a cave Instantly the heavens grew dark The other gods were worried They met in the Milky Way to plan what could be done They decided that music should be played before the cave, for they thought that curiosity would bring Amaterasu to the mouth of the cave Then they planned that a strong young god should seize her and bring her out This plan worked beautifully, and when Amaterasu came forth from the cave the heavens were brilliant with sunshine But the god of storms was banished to earth for his sins

This legend was an effort to explain such things in nature as changes in the weather and an eclipse of the sun Amaterasu interests us further because she was claimed as the first divine ancestress of the imperial family Her grandson, Ninigi, descended to earth and gained dominion of the island of Kyushu, in Japan Later, Ninigi's grandson, Jimmu, brought the country under a single

and agriculture brought no aid to the Koreans The mass of the people is among the most poverty stricken in the world

The Koreans—the population is about 25 000 000—are a distinct branch of the yellow race They are taller than the Japanese and less Mongolian in appearance than the Chinese The Koreans have their own customs and language At an early period they invented an alphabet based on sound (Most alphabets as you know are based on pictures)

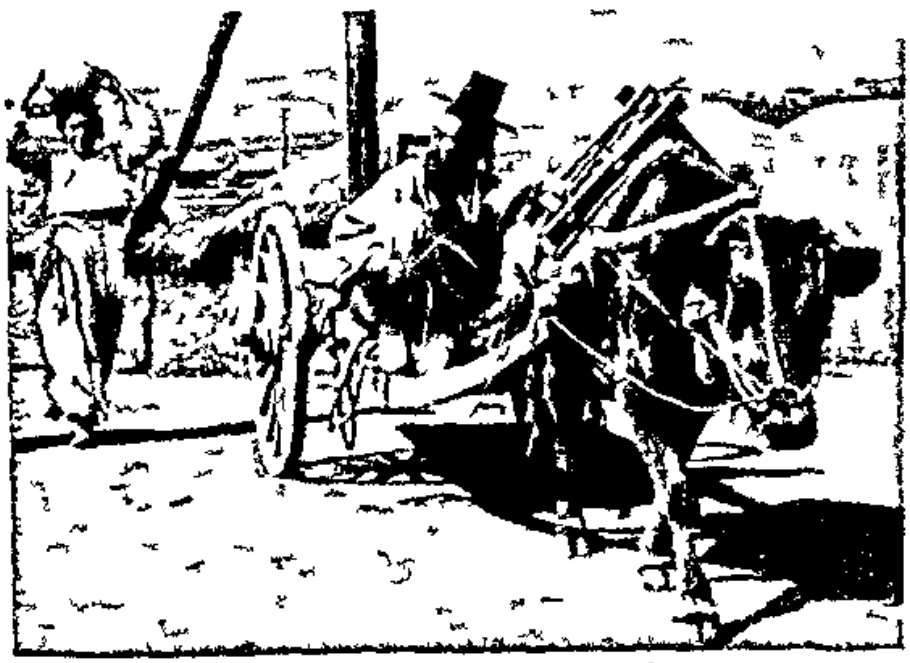
In very early times Korea was divided into several kingdoms which were not united until the tenth century For hundreds of years Korea was an ally of China paid tribute to her, and was deeply influenced by Chinese art, architecture literature practical sciences and philosophy Many Koreans were educated in China For a long time Buddhism which came by way of China was the chief religion of Korea The eighth and ninth centuries were a golden age of Korean art architecture and literature Now here is an ironic fact Japan was still in a barbaric state when China was highly civilized and the Chinese culture spread slowly to Japan by way of Korea as a bridge We all know how Korea was repaid for this service—by the conqueror s heel

Korea as an ally of China was devastated first by the Japanese in the latter part of the sixteenth century Again Korea was laid waste about twenty five years later when she went to the aid of China in her unsuccessful struggle with the Manchus These destructive wars led Korea to isolate herself behind her forbidding rocky shores Foreigners were not welcome The world called Korea the Hermit Kingdom During the nineteenth century however Christian missionaries gradually opened Korea s doors They built many churches and schools and today it is estimated that there are about a half million Christian Koreans

A treaty of commerce and friendship was signed with the United States in 1882 which dealt with Korea as an independent country However after the Russo Japanese War of 1904-05 Korea was made a Japanese protectorate And in 1910 Japan annexed Korea outright Many promises of growing prosperity and welfare were made but actually Japan ruled the peninsula with a heavy hand Trade with other countries was broken off and most Koreans became little more than serfs denied even an education

In 1919 there was a rebellion which the Japanese put down with great cruelty Nevertheless Korean patriots never stopped working for their country s freedom Many of them worked from foreign lands where they had gone to obtain an education

Since the defeat of Japan Korea has been occupied by United States forces in the south and by Soviet forces in the north Japan controlled Korean life so thoroughly that the transfer of authority back to the Koreans themselves will take time But with time and with the help of friendly nations Korea should be able to take her place once more among the free resourceful nations



Both pictures courtesy American Board of Foreign Missions

Korean clothes are usually white and the women toil to keep them spotless Men wear "ch many hats," held on with an inner cap and a headband.

KOREA



This Korean woman with her simple wheel can spin a delicate thread of wool.

IN 1945 Korea was set free from the Japanese Empire to which she had been an unwilling captive for about forty years It had been ruled harshly but the Japanese gave it a lovely name, Chosen meaning Land of the Morning Calm Now Korea is on the way to becoming free and independent once more as promised by the Cairo Declaration of December 1943

Korea is a long narrow peninsula which dips down into the seas between China and Japan It has an area of about 84 000 square miles and is about 660 miles long by 130 miles wide On the west is the Yellow Sea to the southeast Korea Strait and on the east the Sea of Japan Its neighbors to the north, on the mainland of Asia are Manchuria and the Soviet Union Vladivostok, the Soviets chief Asiatic port is only a few miles away, along the coast to the northeast The capital of Korea, Seoul is in the center of the peninsula a few miles in from the western coast Its port is Chemulpo (Jinsen) The most important port is Fusan, on the southeast coast Part of the Korean railway system connects Seoul and Fusan

There is hardly any place in Korea where one may not see mountains, range after range, stretching off to the horizon The longest range rises steeply from the eastern shore Farther in, in the center of the peninsula are the famous Diamond Mountains, or Kongo San Most of the rivers flow west and south The longest is the Yalu, or Amnok, River which forms the dividing line between Korea and Manchuria It falls from the highest peak in Korea, White headed Mountain (or Paitou Shan, in Chinese) The only important river to drain to the northeast, the Tumen, begins on the north side of the same mountain

The climate of Korea is very much like that of the middle Atlantic coast of the United States But partly because of the effect of the mountains, most of the rain falls in July and August

Of all Korea's natural resources, water power is the most important The rivers tumble down from the mountains to sea level in comparatively short distances The great difference between high and low tide on the west coast as much as forty feet in some places could also be used for water power development But only the river falls have been harnessed to any extent as yet

There are large coal reserves, much of it anthracite, but there is no petroleum There are fairly large reserves of iron ore, mostly of low grade as well as magnesium lithium aluminum, lead, zinc, gold, graphite and mica

All of Korea was once heavily covered with forest, but it has been used wastefully in the south In the north, however, there are still good stands of spruce, fir, larch and pine

In spite of the fact that Korea is so mountainous, agriculture is the chief occupation of the people But intensive cultivation for hundreds of years has robbed the soil of much of its fertility Most of the farms are very small, under four acres On such small farms whole families depend for livelihood

Rice, especially in the south, has long been the principal crop But under the Japanese, the Koreans themselves had very *little* of it to eat Most of them live on the second most important crop, barley, grown in the north or, during the winter, raised in fields which yield crops of rice during the humid summer Another southern crop is cotton and millet, wheat, oats grain sorghum, buckwheat, corn, white and sweet potatoes, turnips and cabbage are grown in the north and in the upland valleys

Under the Japanese, water power resources were developed, iron and gold mines were worked, aluminum chemical and refining works were built Crop yields were also increased particularly rice But the products went to Japan The improvement of industry

On the other hand a young man or young woman who is suited to the law will find it one of the most satisfactory of all careers. Law is closely bound up with our daily lives Whenever something that we do has an effect on other people it is almost certain to be the subject of a law or a ruling Law tells us how fast we may drive our cars Law tells us we may not play our radios so loudly that they annoy other people Law tells us we may not own a dog that bites people Law tells us when we may vote and when we may marry

The purpose of law is to bring order into society and to see what things are done in the way that society wishes to have them done. To this end law consists of rules of human conduct that society recognizes and tries to enforce Law deals with mankind in action It also supervises what is done with property after the owner s death Every great body of law has had a long slow growth and has been tested by the experi ence of many generations

Law is a profession for clear thinkers An able lawyer has been trained to reason close ly and exactly He has learned how to build up an argument step by step and to spot any weakness in the argument of his opponent. Legal training is valuable not only because it gives a student knowledge but because it teaches him to think clearly Many people go through law school who never practice law but nevertheless they find that their training is a great help to them in business and in their daily lives

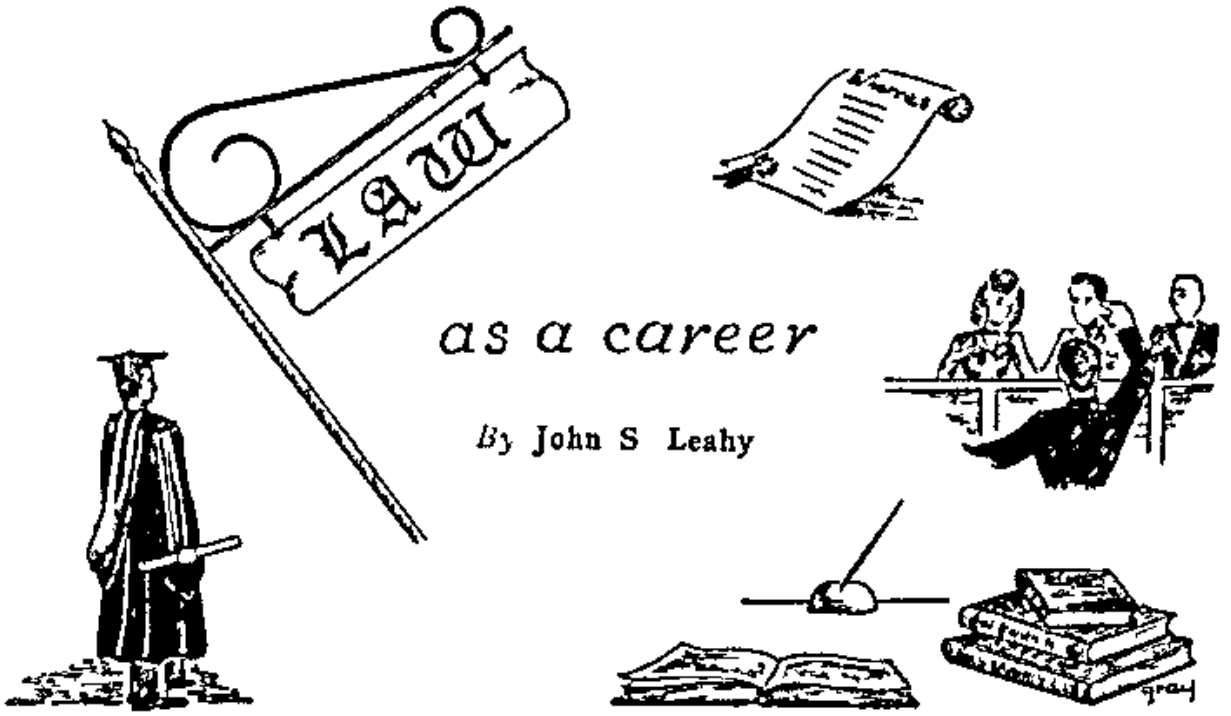
An interest in reading about government is another sign that law may be the right profession for you Law and government are closely related as we may see in the histories of Greece and Rome The great lawmakers of ancient Greece helped to build the finest and most democratic government that the world had then known As a result Greece was able to develop in security the arts of peace and to give us her superb architecture sculpture and drama The Romans were also great lawmakers. During the 700 years that Rome ruled the world her greatest achieve ment was not in conquest but in her mag nificent system of law

The greatness of the United States rests in large part on the work of lawyers who helped to establish its heritage of freedom Lawyers



Wide World

A trial. The judge presides behind the high desk while a lawyer (standing) questions a young woman witness.



as a career

By John S Leahy

NO profession has greater distinction than that of the law If, some day, you become a lawyer you will have every reason to take great pride in your calling Many a national hero has been a lawyer Thomas Jefferson, Abraham Lincoln and Daniel Webster are but a few of the great and courageous men who have given the law their devoted service

Every boy and girl in school is familiar with some of the qualities that a lawyer should have First and foremost is a sense of honor Industriousness is very important and so is a fondness for studying

A lawyer is in a position of great responsibility It is his business to have people trust him with many of their problems and difficulties If he is honorable and dependable, people will have confidence in him When a lawyer becomes known for his honesty as well as for his legal skill, his community will respect him and hold him in high regard In return for this good opinion, he should do all that he can for the public welfare It is his privilege to be able to influence other people and to help many of them become better citizens

A lawyer must be willing to work very hard Often a lawyer s work is so important that he must put everything else aside except the case on which he is engaged A lawyer is honor bound to do his best for his client and must never fail him by shirking

A good lawyer must be a good scholar His knowledge should be profound He must be versed in the law of the past as well as the present, and he will be obliged to keep up-to-date on the new laws and rulings that are constantly coming into effect If you are thinking of becoming a lawyer, you should enjoy studying and find it a pleasant and natural thing to do As long as you are practicing law, you will never cease studying

A lawyer should have a strong body, a keen mind and a good heart He should be patient and sympathetic, logical and imaginative, gentle and courageous, generous and just Some lawyers—especially trial lawyers —must be able to speak eloquently Other lawyers have little need for great skill in speaking because they do most of their work in writing

Legal work that is done in writing includes drawing wills and contracts and making out income tax returns To do these things well requires both care and knowledge Care is also needed in the preparation of a law case A lawyer who is hasty or careless is usually at the mercy of painstaking opponents

These are some of the reasons why a lawyer must be the kind of person who enjoys being thorough Unless you delight in taking pains with your work, legal work will be drudgery for you You will feel that you are living—as Chief Justice Kenyon put it—on "unbuttered sawdust"

Lord Erskine replied Consider the injustice that might be done to one charged with a crime, for whom a lawyer of prominence refuses to appear Any cause that is fit for any Court to hear is fit for any lawyer to appear in on either side No one can determine the real right of a cause until both sides are heard

Only a judge and jury have the duty or the right to determine the guilt or innocence of a person prosecuted for a crime Between the duties of a judge and of the lawyers who are prosecuting or defending a case, the difference is sharply drawn As the famous Dr Samuel Johnson told his friend Boswell it is a lawyer's business to state facts fairly but it is not the lawyer's business to form an opinion or to judge A lawyer should say all that he can for his client and then hear the judge's opinion

If you become a lawyer you may find yourself pleading not only for a person but for a cause Daniel O'Connell the Irish advocate, had an immense practice but he found time to work for a cause in which he believed He made the English Parliament repeal the laws which prohibited a Catholic from sitting in Parliament It may be that you too will find some law that you feel is unjust and you may devote a great deal of time and effort to having that law changed

Or you may find that there is some benefit that your community needs—the building say, of a new bridge in place of an old one which is inadequate or unsafe—and you may need all the skill at your command to obtain that benefit You may need to convince your state legislature before it will pass a law that will make it possible to build the bridge If there happen to be some able lawyers who are opposed to what you want to do you will have a legal battle on your hands and you will need to be unusually skillful in order to win your point



Portia, one of Shakespeare's most appealing heroines, is a famous woman She is disguised as a man in the long and robe worn by lawyers in her day

SINCERITY LOGIC AND FEELING ARE NECESSARY TO PLEAD SUCCESSFULLY

It is impossible to say exactly what qualities make a great advocate He must be a person of profound learning He must know how to present his arguments logically He must know how to awaken sentiment and to sway the feelings of the jury Above all he must impress the jury with his sincerity and convince them that every declaration he makes is true

Daniel Webster was a great advocate You may have heard of Demosthenes who is reputed to have been the greatest orator of ancient Greece. And perhaps you have read some of the invectives that Cicero hurled against Catiline Some people believe that neither Demosthenes nor Cicero ever uttered a more eloquent speech than did Daniel Webster at his greatest Webster was as effective in a murder case as in cases involving property or in cases involving constitutional law

An advocate should resist the temptation to be funny Wit should be used with care and sarcasm should be avoided The good lawyer tries to make the jury feel that it would be doing an injustice to decide against his client In order to do this a lawyer must know his case as well as an actor knows his lines One of the chief qualities needed to make a great advocate is forgetfulness of self He must put the winning of his client's case above all other projects

Portia is one of the greatest advocates in all literature Portia's plea for mercy in The Merchant of Venice was a supreme piece of persuasion. Read it again and try to see how skillful it is in appealing to the feelings of her hearers.

Until quite recently a woman lawyer was a



The judgment of Solomon, I Kings 3 16-28 As in Solomon's day a modern judge must understand human nature in order to make wise decisions

conceived and drafted the Declaration of Independence and composed the Constitution and lawyers have guided the growing nation from that time to this

When government ignores the legal rights of man the result is tyranny Tyrants such as Hitler, for instance ride rough shod over human rights Great courage is needed to oppose a despot, but many lawyers have shown such courage

Peter the Great was a tyrant When he was tsar of Russia it happened that he had need of the services of skilled mechanics He went to England to secure them and persuaded 500 of them to return with him to Russia While Peter was in England he learned how Sir Edward Coke one of the greatest lawyers of all time had compelled King Charles I to call a meeting of Parliament He learned moreover that in England lawyers were opposed to absolute power in a king There are but three lawyers in Russia Peter exclaimed and I will have them hanged on my return!

A STRANGE WAY TO SETTLE AN ARGUMENT—THE TRIAL BY ORDEAL

When good laws are forsaken all sorts of curious and terrible injustices may happen Trial by ordeal is a famous example For centuries after the fall of Rome the reasonable trial that had given so much satisfaction for so many years was abandoned The Saxons and the Normans adopted a strange method of settling disputes when they did not wish to resort to personal vengeance They called it trial by ordeal In those days an accused person was in a most unhappy predicament especially if he happened to be innocent The accused was ordered to undergo an ordeal which was almost certain to do him physical hurt For instance in one famous trial by ordeal the accused was ordered to walk over nine burning plowshares The idea was that if the accused could walk over these fiery implements—or undergo some other unpleasant ordeal—without getting hurt he must be innocent.

In the United States and Canada every person charged with a crime is presumed to be innocent until he has been proved guilty And every such person has the right to be represented by counsel The United States was the first nation to give a person charged with a serious crime the right of counsel

Thoughtless persons often do not understand how an honorable lawyer can represent persons who are guilty of crime When you become a lawyer if you defend a man believed to be a criminal many people may ask you why you do it Let us see what William Seward one of America's greatest lawyers had to say on this subject

A murderer was on trial for his life and Seward appeared in court to defend him The community was outraged to think that a man of Seward's ability and standing should appear for such a criminal Seward replied that every man living under the American flag no matter with what he may be charged is entitled to a fair trial

There was severe criticism of Lord Erskine when he appeared in defense of Thomas

Paine Erskine replied Consider the injustice that might be done to one charged with a crime for whom a lawyer of prominence refuses to appear Any cause that is fit for any Court to hear is fit for any lawyer to appear in on either side No one can determine the real right of a cause until both sides are heard

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In Portia s time a woman lawyer was a

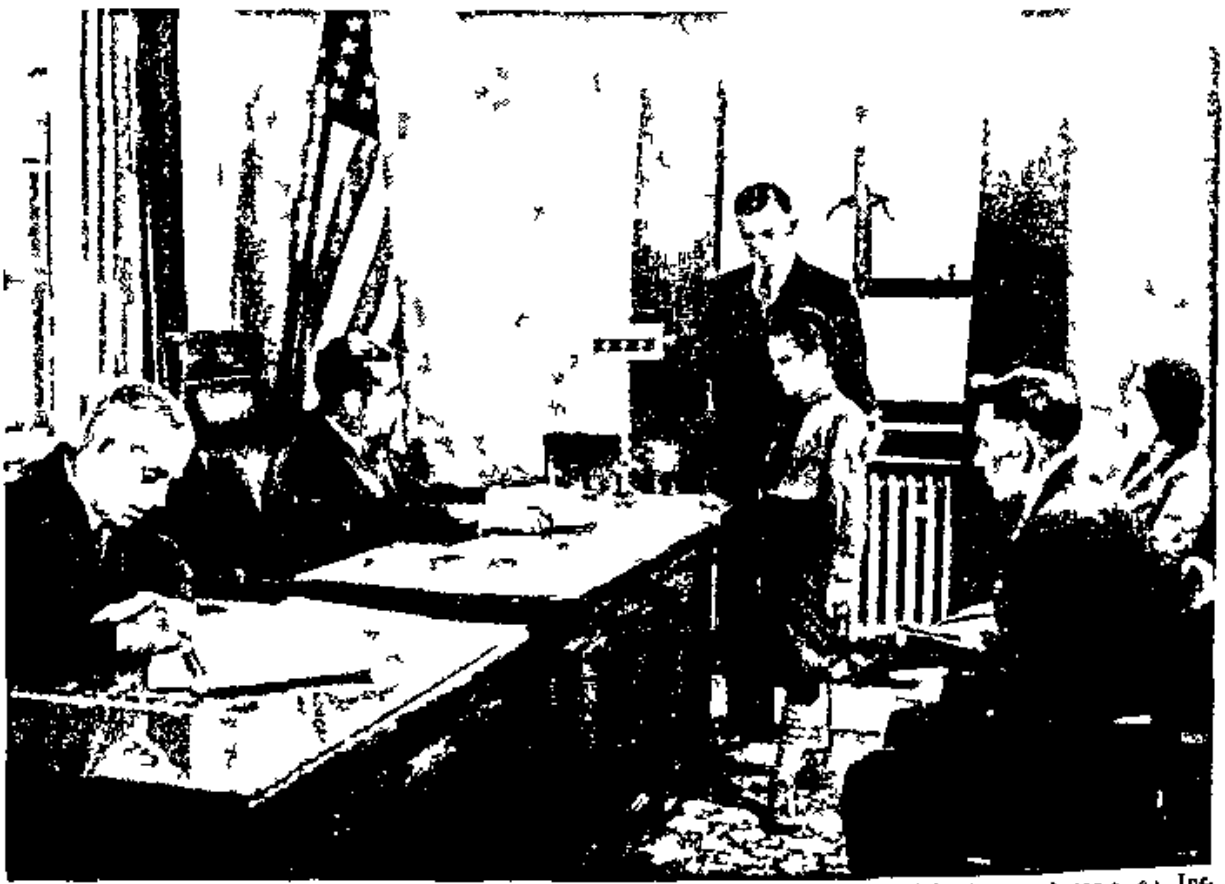
rarity But today many women find success and contentment in the legal profession It is true that few of them attempt to plead as Portia did Nevertheless there are many branches of the law that are open to women and many positions for them both in private law firms and in government employment

Many young lawyers begin their careers by entering an established law firm This is an excellent thing to do The beginner will be associated with older and more experienced lawyers and will be able to benefit from their wisdom and advice After a number of years in a law firm the young lawyer will be in a good position to make an important choice He may decide to remain in the firm If he is successful he may in the course of time look forward to becoming a partner Or he may decide to leave the firm and set up in business for himself

Many men and women look forward to a practice of their own An independent lawyer may live where he pleases and work in the country or in a small town or in a large city However in the very large cities it is almost impossible for a young lawyer to get started by himself Even in the small towns a beginner is likely to have quite a struggle to win recognition for his abilities and before enough clients seek his help so that he can earn his bread and butter Nevertheless it is a fine thing to be independent to hang out one's own shingle and to do the legal work one likes best If this is your goal it will pay you to use your judgment in deciding whether to seek it at once or to wait until you have gained experience by working with an older lawyer or in a firm of lawyers

Lawyers may specialize in the work they do Some become income tax experts Some specialize in wills Some are most interested in labor relations and others choose to specialize in international law Some act as counsel to a business or an industry Moderate sized companies as well as great ones need legal advice in order to avoid mistakes of many kinds. They also need lawyers to defend their interests against offenses or serious crimes such as swindles forgeries embezzlement and arson

Government offers many opportunities to young lawyers and provides the opportunity for advancement Most state and federal legislatures are largely composed of lawyers



Paul Parker photo from National Probation Association, Inc.

A boy and a judge talk things over The judge of a Children's Court has a chance to help many young people.

JUDGES HOLD POSITIONS OF HIGH HONOR



A me pho

A lawyer taking the oath of offi e as a fede al judge He swears to upho d the Constitution and the laws A fede al judge passes on cases coming under the jurisd tion of the national go ernment.



B h Comb ne

In Great B ita n, wigs are wo n by the judges and barris e s a custom seve al hund ed yea s old



A b l t u h l a and la orma on Serv e

The h ghest law court in Fran e is the Court of Cassation. As used in French law this wo d means the annulment of a judgment or de ree. This picture shows ma the line robes and ermine worn by high justi es of the court.

Another goal well worth considering is a position as a judge

A judge is the officer who presides over a court A brief list of the different kinds of courts in the United States alone will give you an idea of the many different positions which judges hold First let us look at the federal courts These include the United States Customs Court the Court of Customs Appeals the Court of Claims district courts and circuit courts of appeals Above them all is the most powerful federal tribunal the Supreme Court

Each city in the United States has a police court Some of the larger cities have special courts, such as juvenile courts and courts of domestic relations

The systems of courts differ in the different states However each state usually has courts of justices of the peace county or district courts and a supreme court.

Now let us turn to the kind of training that a law student must undergo before he will be admitted to the bar The word 'bar means the whole body of lawyers who are qualified to practice in a given jurisdiction The origin of this word is interesting In England in the Inns of Court, there used to be an actual bar which separated the law students from the lawyers themselves. When a student was called to take his place at the bar he acquired the rank of barrister

It is necessary to pass an examination for admission to the bar In Canada, a law student will first go to a university for from five to six years to receive the degrees of Bachelor of Arts and Bachelor of Laws He then spends one year in a law office At the end of this time if he is twenty three years old or more he will take his bar examination

In the United States the training which a student must have differs widely in different states The courts in each state determine the requirements for admission to the bar of that state.

Many types of legal training are offered to law students There are the fine law schools of the great universities There are many night schools. A college degree is necessary for entrance to some law schools but not to others Three years of intensive study are required for a law degree in the day law schools four years, in the night schools

Tuition rates in day schools vary from $100 to about $450 Night school rates are lower Scholarships and student loan funds are available for students who need financial aid Before you choose your school it would be a good idea to send for the approved list of law schools published by the American Bar Association

Any lawyer who wins the good opinion of the bar is reasonably certain of success in his practice A lawyer is sure to win an honorable place in his community as well as a comfortable living and even fame and high position, if his chief aim is to accomplish justice and if he is willing to work hard

Certificate of Partnership

The undersigned do hereby certify that they *(have) (have not)* entered into a partnership agreement under the name and style of

Doe and Roe

at 275 Fifth Avenue New York N Y
in the County of New York State of New York, and do further certify that the true and real full names of all the persons conducting or transacting such partnership, with the residence and business addresses of each person, and the age of any who may be infants, are as follows:

NAME	RESIDENCE	BUSINESS ADDRESS
John Doe	116 East 58 Street,	275 Fifth Avenue,
	New York, N. Y.	New York, N. Y.
Richard Roe	327 East 24 Street,	275 Fifth Avenue,
	New York, N. Y.	New York, N. Y.

In Witness Whereof, We have this 15th day of December 1945 made and signed this certificate.

John Doe

Richard Roe

State of New York,
County of New York } ss.:

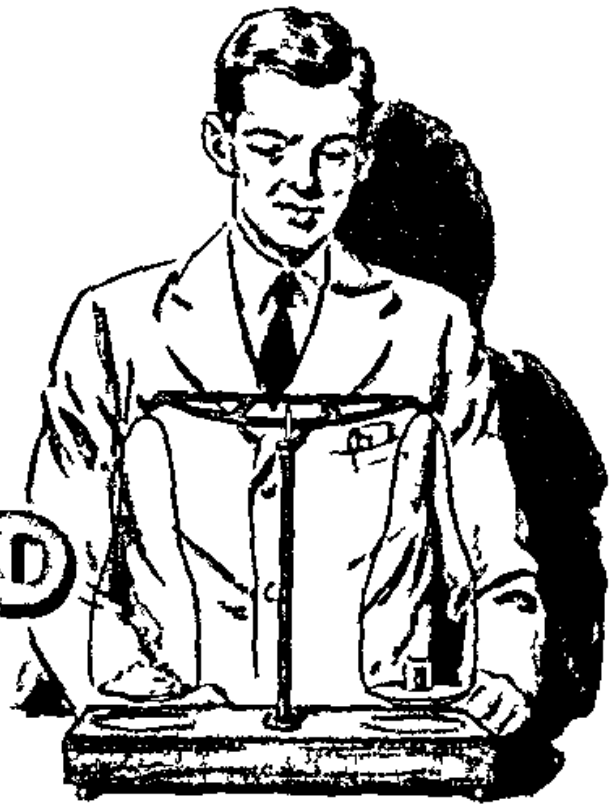
On this 15th day of December 1945 before me personally appeared

John Doe and Richard Roe

to me known and known to me to be the individual s described in, and who executed the foregoing certificate, and they thereupon duly acknowledged to me that he? executed the same.

Printed forms are often used for business agreements

HOW THINGS ARE MEASURED



ONE of the corner stones of our civilization is the system of weights and measures We could not carry on the everyday business of life without it. The grocer weighs out so many pounds of potatoes for your mother, the druggist weighs drugs in making up your doctor s prescription. When you buy ribbon or cloth in a store, the sales person measures out the length you need The tailor takes many measurements when he makes a suit for your father

Measurements are also necessary in the crafts and professions The carpenter uses his rule many times a day Thousands upon thou sands of measurements must be made in building a great bridge or a lofty skyscraper Weights or measures or both are very im portant in chemistry, in physics, in astron omy, in zoology, in many other sciences In fact a great thinker once said that science is measurement.

One of the most important measurements is *length* We measure length when we find out the distance between two points This may be very small, as when we measure a half inch margin on a notebook page It may be great, as when we calculate the distance of the earth from a sister planet. The inch is a unit of length, so is the yard so is the mile. Length is sometimes called linear measure

Certain things have not only length but also *width* A floor, a table top, a building lot, a cotton plantation—all have both length and width. To measure things like these, we use a unit of *area*, such as a square foot, or an acre or a square mile. Area is sometimes called square measure

Other objects have three dimensions *length width and thickness* Bricks have three dimensions so have baseballs so have bottles and tables and chairs and houses. Length width and thickness are all equal in the case of objects that we call cubes Your little brother s alphabet block is a cube. When we measure a cube, or any other thing that has three dimensions, we find the amount of space that it takes up—that is, its *volume*, or its bigness. Some of the volume measures are named after the cube—cubic inches, cubic feet and cubic yards

Suppose we want to find out what quantity of beans or milk will fit into a certain space For this purpose we use a hollow container that has a certain volume and we fill it with beans or milk. We call a container of this sort a measure of *capacity* A quart and a gal lon are measures of capacity, so are a peck and a bushel

Now we come to the two measurements of *mass* and *weight* It is very important to know the difference between them. What is mass? It is, to put the matter as simply as possible, the actual amount of stuff there is in a body An iron ball and a baseball of the same vol ume, or bigness, take up the same space. But there is more stuff packed into the iron ba than into the baseball It has more *mass*

The iron ball also has more *weight*

the baseball Now when we come to consider weight we must deal with the laws of gravitation Gravitation is the force by which everything in this world attracts every other thing. If you let a baseball fall from your hand it does not hang in space but falls to earth The earth has pulled it down, has attracted it We tell about the force of gravitation in the article beginning on page 739

WE WEIGH THINGS BY FINDING OUT THE PULL OF THE EARTH ON THEIR MASS

The more mass an object has, the stronger will be the attraction between it and the earth Our entire system of weights is based upon this fact. You see, the weight of an object simply represents the pull of the earth upon its mass We calculate weight by means of a scale This is an instrument which registers the pull of the earth in terms of certain units —grains, ounces, pounds and so on

The nearer to the center of the earth a thing is, the stronger the pull of the earth upon its mass will be, that is, the more it will weigh On the other hand, the farther it is from the center of the earth, the less it will weigh.

A bar of lead contains a certain amount of lead, its mass is always the same. But a bar of lead on a mountain top would weigh a little less than the same bar at the bottom of a mine, because it would be farther away from the center of the earth If the bar of lead could be carried up a thousand miles into the air in a rocket ship, the lead would weigh considerably less than it did on the surface of the earth.

Since the weight of an object differs according to where it is weighed, it is clear that its mass would represent a more accurate means of measurement than its weight Yet, we generally weigh things instead of finding out their mass This is so partly because it is a rather difficult task to calculate the mass of an object, while it is generally very easy to weigh the same object

Besides, there is very little difference between the weight of an object at one altitude, or height, and its weight at another unless the second altitude is much greater than the first. For example, a bag of potatoes that weighs 10 pounds at sea level will weigh about 9 and 99/100 pounds if it is on the top of a mountain four miles high.

Of course a grocer would protest most bitterly if we made him weigh out potatoes on a rocket ship a thousand miles above the surface of the earth, since it would take many more potatoes to register ten pounds at that altitude than at sea level. But so far this situation has never come up Both the grocer and his customer are satisfied to use weight rather than mass as a means of measurement in buying and selling potatoes and other things.

So much, then, for weight Another important thing that must be measured is *time* The second is the unit of time that has been adopted in practically all the civilized countries of the world This unit comes from the spinning of the earth upon its axis We use the word day to refer to the time that the earth takes to make a complete turn about its axis.

The day is divided into twenty four parts, called hours. Each hour is divided in turn into sixty minutes, and each minute into sixty seconds A second, then, is the 86,400th part of the time it takes the earth to spin around once. (We get the number 86,400 by multiplying 24 x 60 x 60)

There are many, many other measurements besides those that we have just named. There is the *density* of an object, which is the relation between the stuff it contains and the space it takes up—or, to use the language of science, the ratio of its mass to its volume There is the measurement of *energy* There is the measurement of *velocity*, or speed in a single direction There are also measurements of *pressure, heat, electrical current* and many other things.

ALL MEASUREMENTS ARE BASED ON THOSE OF LENGTH, WEIGHT AND TIME

It would be a terribly difficult task to learn to weigh and measure things if we had entirely different kinds of units for different kinds of measurements. Men have found, however, that all measurements are based on three—those of length, weight and time. Let us show how.

Suppose we accept the foot as our unit of length If we wish to measure the area of a building lot, we do not invent an entirely different sort of measure We use the square foot. If we wish to measure the area of a lot that is twenty feet long by twenty feet wide we multiply its length by its width (20 x 20) and that gives us its area—400 square feet.

Suppose we want to measure volume We still use the foot as the basis of our measure of volume, the cubic foot If we want to measure the volume of a box, each side of which is two feet long, we multiply the length width and thickness together (2 x 2 x 2) The volume of the box is eight cubic feet.

If we wish to measure speed, we take some measure of *length* and some measure of *time*

VOLUME, MASS and WEIGHT

VOLUME

THE WATER AND THE LEAD HAVE THE SAME VOLUME — 1 CUBIC INCH.



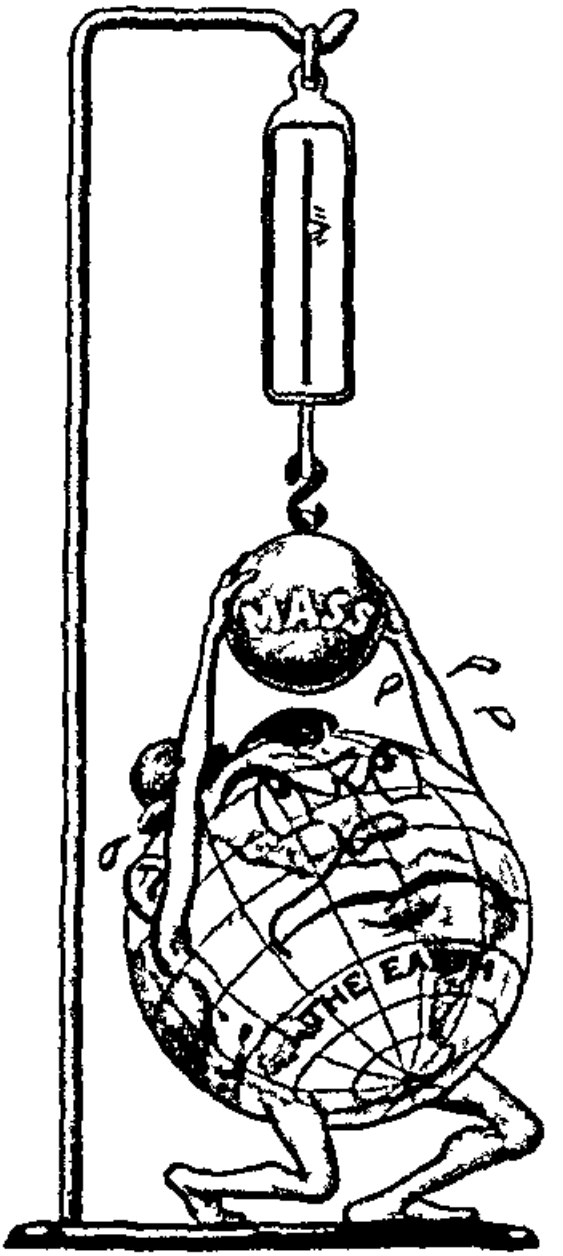
MASS

THE VOLUME OF THE WATER SHOWN IN THIS PICTURE IS MORE THAN ELEVEN TIMES AS GREAT AS THAT OF THE LEAD. YET THE WATER AND THE LEAD SHOWN HERE HAVE THE SAME MASS. THERE IS JUST AS MUCH STUFF PACKED IN THE SMALL AMOUNT OF LEAD AS THERE IS IN THE LARGE AMOUNT OF WATER.



WEIGHT

THE SCALE REGISTERS THE PULL OF THE EARTH ON THE MASS OF AN OBJECT.



We say that Bill Jones can walk three miles an hour we say that a fast runner can go a hundred yards in ten seconds Or suppose we want to measure energy The unit called the foot pound comes from the foot a unit of *length* and the pound a unit of *weight* The foot pound is equal to the work done in raising one pound avoirdupois against the force of gravitation the height of one foot

Now in calculating length or weight, or time or the measurements that are built up from these three, we must have a series of units that all people will know and accept. Suppose, for example, that you tell an architect to build you a house as long as forty canes laid end to end and as wide as twenty canes Canes are of many different sizes Therefore your architect might use one size of cane for his measurements while you might have an entirely different length of cane in mind

MEASUREMENTS THAT ARE ALWAYS THE SAME AND THAT ARE ACCEPTED BY ALL

But if you tell the architect that the house is to be so many feet long and so many feet wide, there can be no misunderstanding. You and he and all your friends accept the foot as a unit of measurement A foot is a foot whether it is measured in Boston, or New York, or Chicago or San Francisco And so it is with units of area and volume and time, and so on

It took many centuries before men worked out accurate units of measurement The first ones were rough and ready Men used as measures the human hand or the human foot, or the length of a furrow made by a plow or the distance that a man could travel in a single day s journey The ancient Chinese had an uphill mile and a downhill mile Since it is harder to walk uphill than downhill, they made the uphill mile shorter!

Of course measures like a human hand, or a human foot or the length of a furrow are very inexact One man s hand or foot may be much longer than another s A furrow made by one plowman might not be nearly so long as that made by another As time went on men found that it would be much more satisfactory to use measures that would never change

Probably something like this happened Old So and So, who lived thousands of years ago became dissatisfied with the old measure of length the human foot—any human foot He prepared a stick as long as his own foot and used it to measure his fields. He then persuaded his friends and neighbors to prepare other sticks of exactly the same length and to use these sticks in all their measurements. It is clear that these people would have a far more satisfactory measure of length than ever before

We do not know when the rough measurements of the earliest times gave way to a series of weights and measures based on accurate units We know that the ancient Egyptians had such a system and that similar systems were used in other ancient countries Unfortunately, different regions adopted different measures.

When the Romans established their mighty empire, they decided that they would set up a series of units that would be the same all over the empire They made a rod of bronze that they called a *pes* (the Latin word for foot), and this served as the unit of length. They made a bronze weight that they called the *libra* or pound and this served as the unit of weight. (The abbreviation lb for pound comes from this Latin word) The bronze *pes* and *libra* were kept under guard in a temple They became the standard units of length and weight

After the fall of the Roman Empire there was great confusion again Each region developed its own system of weights and measures and very unsatisfactory they were. In the course of time they were gradually made more accurate Yet they were still far from perfect The various units were jumbled together in the strangest way, apparently without rime or reason

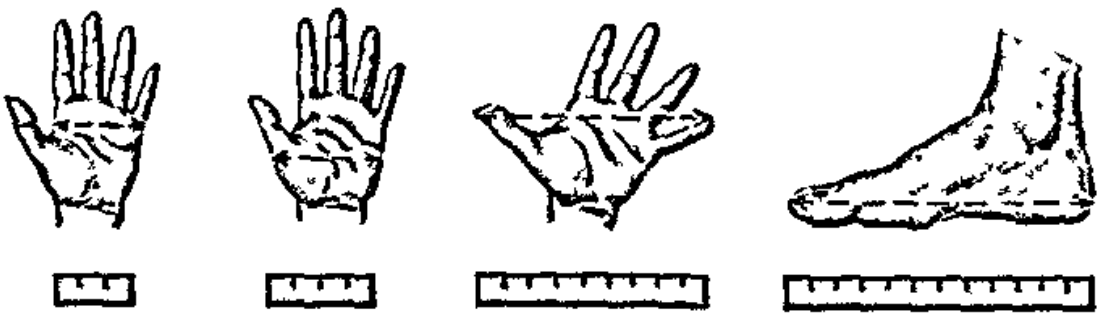
It was not until toward the end of the eighteenth century that a really scientific system of weights and measures was set up This system was the work of a group of noted French scientists They accepted as their unit of time the second which was already firmly established but they did not accept any of the other existing units of measurement.

THE FAMOUS METRIC SYSTEM IS BASED ON THE UNIT KNOWN AS THE METER

They chose as their unit of length the ten millionth part of an imaginary line running through Paris from the Equator to the North Pole After careful measurements, they worked out the length of this unit which they called the meter (from the Greek *metron* or measure) It is about 39⅓ inches long With the meter as a basis they set up the metric system, which is quite generally accepted as the best system of weights and measures that the world has ever known

The metric system is ever so much simpler than our own Take our various measures of

ORIGIN of some of our MEASURES

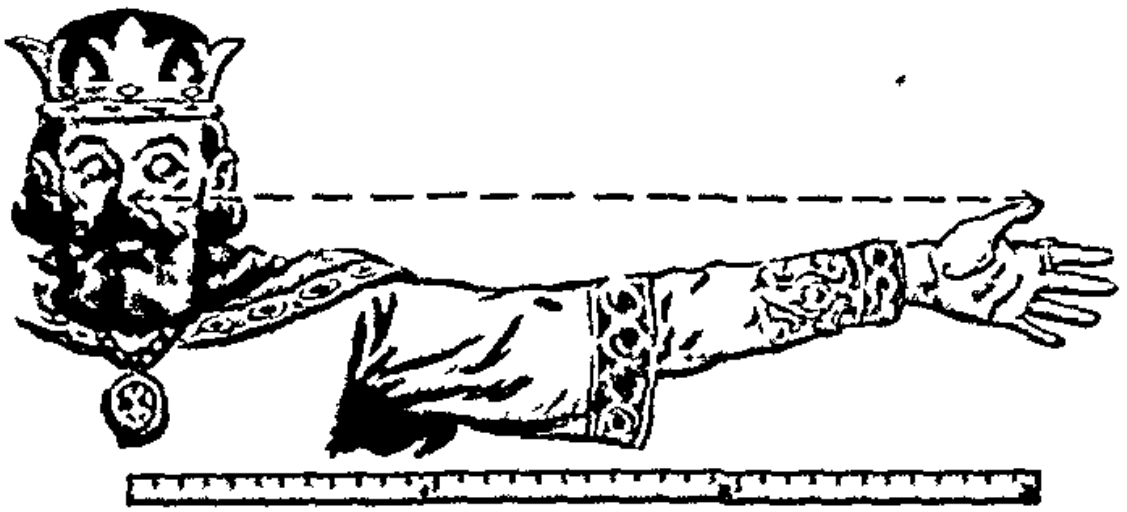


THE PALM
3 INCHES

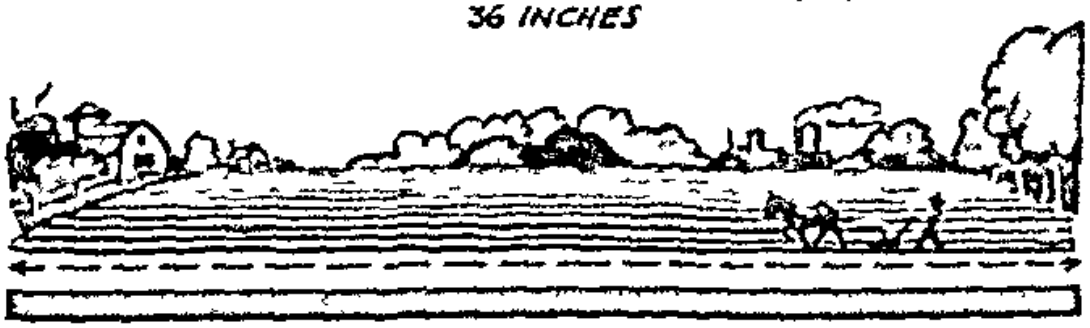
THE HAND
4 INCHES

THE SPAN
9 INCHES

THE FOOT
12 INCHES



THE YARD
(DISTANCE FROM NOSE TO END OF THUMB OF HENRY I OF ENGLAND, AS ESTABLISHED BY ROYAL DECREE.)
36 INCHES



THE FURLONG
(FURROW-LONG; LENGTH OF ONE FURROW.)
660 FEET

, for example. Our chief unit of length is the yard It is divided into 3 feet and the foot is divided into 12 inches As for measurements larger than the yard we have the rod, which is equal to 5½ yards or 16½ feet the mile which is equal to 1 760 yards or 5 280 feet and other measures All this is very complicated.

THE DECIMAL METHOD OF RECKONING IS USED IN THE METRIC SYSTEM

Reckoning is much simpler in the metric system. The meter is divided into ten parts and each of those into ten still smaller parts and so on This is called the decimal method, and throughout the whole metric system the decimal method is used American and Canadian money is reckoned in this way Thus 10 mills make a cent 10 cents make a dime, 10 dimes make a dollar

A meter then is divided into tenths, hundredths and thousandths the larger units are 10 meters 100 meters and 1 000 meters Each of these units has a name, consisting of the word meter plus a prefix taken from Latin or Greek (A prefix is a combination of letters used before a word to give it different or added meaning.)

These prefixes are deci (1/10), centi (1/100), milli- (1/1000), all taken from the Latin, and deca- (10), hecto (100) and kilo (1,000), taken from the Greek. A deci meter, then is 1/10 of a meter a kilometer is 1,000 meters. As you see the Latin prefixes are used for measures smaller than the meter the Greek prefixes, for measures larger than the meter

And so we have the following system of units of length 10 millimeters make a centi meter, 10 centimeters make a decimeter 10 decimeters make a meter 10 meters make a decameter, 10 decameters make a hectometer, 10 hectometers make a kilometer Isn t this an easy way to reckon?

As we said before, the meter is the basis of the metric system, all the other measurements are founded upon it. The unit of area is the *square meter*, the unit of volume is the *cubic meter*, or *stere* The *liter* is the unit of capacity A liter of anything is the amount that is contained in a measure 10 centimeters long by 10 centimeters wide by 10 centimeters deep. The unit of weight is the *gram* It represents the weight of one cubic centimeter of pure water at a temperature of 4 degrees Centigrade (about 39 degrees Fahrenheit).

The same prefixes that are used with the word meter to indicate smaller and larger units are also used with liter and gram. Thus, a centiliter is 1/100 of a liter, while a kilogram is 1,000 grams. In the case of square measures, the word *are* is used for 100 square meters, the word *hectare* for 100 ares or 10,000 square meters.

The metric system was accepted by France in 1795 Since that time it has made amazing progress Today the United States and the British Empire are the only countries of any importance that have not officially adopted the system (Some of the countries that now use metric weights and measures also use the older systems.)

The United States and the British Empire still use the old weights and measures, however, scientists everywhere in these countries use the metric system. The American weights and measures are much the same as those employed in the English colonies of the New World before the United States became a nation. Now American and British systems differ slightly The British gallon for instance, is greater than the American gallon

Since Canada forms part of the British Empire, she uses the British system of weights and measures, except in a very few cases For example a Canadian would say that Mr Smith weighs 140 pounds An Englishman would say that he weighs 10 *stone*, a stone being equal to 14 pounds. But such exceptions are rare.

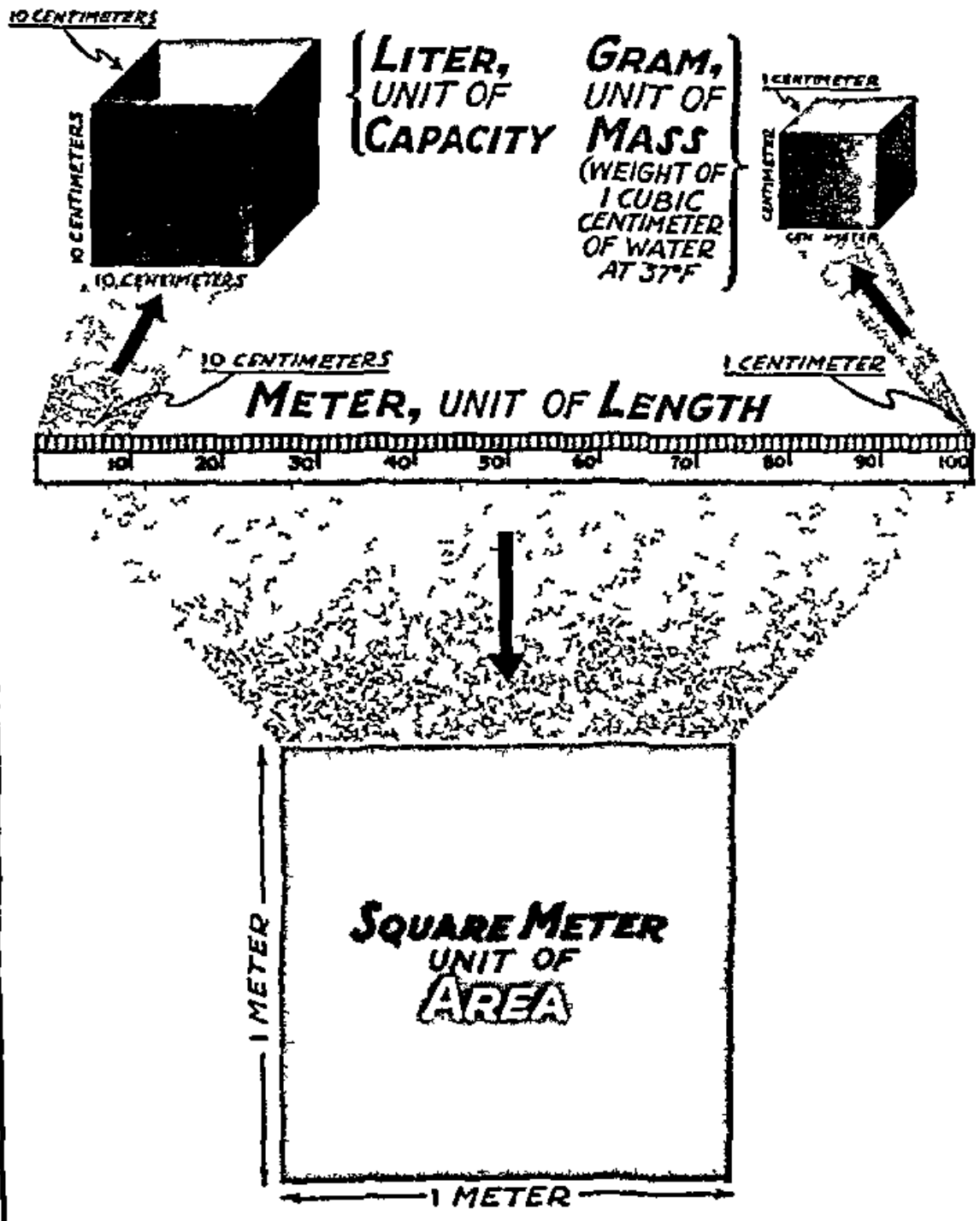
OTHER MEASUREMENTS EMPLOYED IN VARIOUS TRADES AND PROFESSIONS

On the last page of this article we give a table of the common weights and measures. In addition to these, a good many others are used in various trades and professions. Printers, for example, reckon sizes of type not in inches but in *points* A point is a seventy second of an inch. The letters in this paragraph, for example, are set in 10-point type. That means that each letter is ten seventy-seconds of an inch high.

Tailors use the word *bolt* as a measure of cloth The bolt generally measures 40 yards, though the length varies with different fabrics and manufacturers. Electricians often use the measurement called the *mil* (1/1000 of an inch) in electrical work particularly in indicating the thickness of wire When you come to the chapters on electricity, you will learn many other special measures used in that field

Shoe sizes are reckoned by the old measure called the *barleycorn*, which is equal to a third of an inch. A size 10 shoe, therefore is an inch longer than a size 7 shoe The barleycorn is used in a system of thirteens. This

The METER as the basis of the METRIC SYSTEM

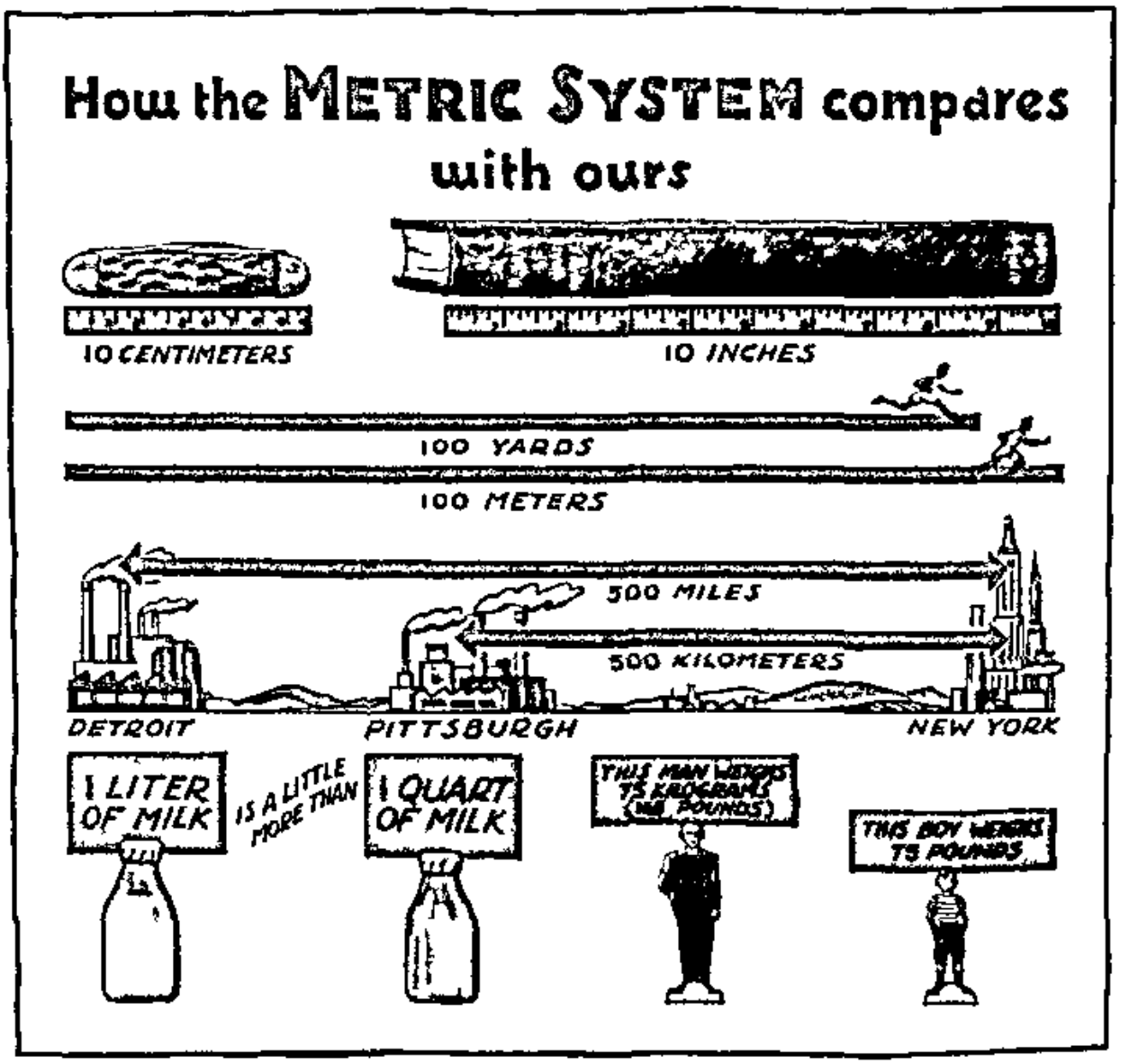


means that when one reaches 13 in measuring shoes by barleycorns, one does not go on to 14 but begins all over again with 1

Buttons are measured by *lines*, each line is equal to 1/40 of an inch Therefore when one speaks of a 30-line button, one means a button that is ¾ of an inch in diameter

Astronomers often use very big numbers. is the distance that light travels in one year —a really respectable distance, seeing that the speed of light is about 186,230 miles a second A light year is equal to 65 700 astronomical units or about 6 000,000 000 000 miles

There are many other kinds of measurements besides those that we have given here



You will find it interesting to use the table on the next page in order to check the accuracy of the pictures.

If they measured distances only in terms of miles, the resulting figures in some cases would be so long that they might well discourage even an astronomer! Therefore several measures of length larger than the mile have been adopted The measure called the *astronomical unit* is equal to nearly 93 000 000 miles.

For particularly great distances the unit called the *light year* is used. The light year

Now rulers and scales and containers and other things with which we weigh and measure are apt to vary just a bit In practically every country therefore there is a government agency which has the task of seeing that weights and measures are kept as accurate as possible In the United States there is the Bureau of Standards in Canada the Weights and Measures Service.

TABLE OF WEIGHTS AND MEASURES IN COMMON USE

LONG MEASURE

12 inches (in or ")	= 1 foot (ft. or ')
3 feet	= 1 yard (yd.)
5½ yards or 16½ feet	= 1 rod (rd.)
40 rods	= 1 furlong (fur.)
8 furlongs or 1,760 yards or 5,280 feet	= 1 mile (mi.)
3 miles	= 1 league

SQUARE MEASURE

144 square inches (sq. in.)	= 1 square foot (sq. ft.)
9 square feet	= 1 square yard (sq. yd.)
30¼ square yards or 272¼ square feet	= 1 square rod (sq. rd.)
160 square rods	= 1 acre (A.)
640 acres	= 1 square mile (sq. mi.)

CUBIC OR SOLID MEASURE

1,728 cubic inches (cu. in.)	= 1 cubic foot (cu. ft.)
27 cubic feet	= 1 cubic yard (cu. yd.)
24¾ cubic feet	= 1 perch

WOOD MEASURE

16 cubic feet (cu. ft.)	= 1 cord foot (cd. ft.)
8 cord feet or 128 cubic feet	= 1 cord (cd.)

LIQUID MEASURE

4 gills (gi.)	= 1 pint (pt.)
2 pints	= 1 quart (qt.)
4 quarts	= 1 gallon (gal.)
United States gallon	= 231 cubic inches in most states
British Imperial gallon	= 277.27 cubic inches

DRY MEASURE

2 pints (pt.)	= 1 quart (qt.)
8 quarts (qt.)	= 1 peck (pk.)
4 pecks	= 1 bushel (bu.)
United States bushel	= 2,150.42 cubic inches, in most states
British Imperial bushel	= 2,218.19 cubic inches

AVOIRDUPOIS WEIGHT

(Used for all goods except precious metals, precious stones and drugs)

437½ grains (gr.)	= 1 ounce (oz.)
16 ounces	= 1 pound (lb.)
14 pounds	= 1 stone (English)
100 pounds	= 1 hundredweight (cwt.)
2,000 pounds	= 1 short ton (S. T.)
2,240 pounds	= 1 long ton (L. T.)

TROY WEIGHT

(Used in weighing precious metals and precious stones)

24 grains (gr.)	= 1 pennyweight (pwt. or dwt.)
20 pennyweights	= 1 ounce (oz.)
12 ounces	= 1 pound (lb.; the troy pound is lighter than the avoirdupois pound which contains 7,000 grains)

APOTHECARY'S WEIGHT

(Used in making up doctors' prescriptions)

20 grains (gr.)	= 1 scruple (℈)
3 scruples	= 1 dram (dr.)
8 drams	= 1 ounce (oz.)
12 ounces	= 1 pound (lb.; the apothecary's pound has the same weight as the troy pound)

TIME MEASURE

60 seconds (sec.)	= 1 minute (min.)
60 minutes	= 1 hour (hr.)
24 hours	= 1 day (da.)
7 days	= 1 week (wk.)
365 days or 12 months	= 1 common year
366 days	= 1 leap year
100 years	= 1 century

MARINER'S MEASURE

6 feet	= 1 fathom
6,080 feet	= 1 nautical mile
3 nautical miles	= 1 marine league
1 knot (measure of speed)	= 1 nautical mile per hour

HOW METRIC WEIGHTS AND MEASURES COMPARE WITH OURS

A meter is about 39⅓ inches (39.37 inches)

A centimeter is about ⅖ of an inch (.39 inch)

A kilometer is about ⅝ of a mile (.62 mile)

A square meter is about 10¾ square feet (10.76 square feet).

A hectare is about 2½ acres (2.47 acres)

A cubic meter or stere is about 35⅓ cubic feet (35.31 cubic feet).

A liter liquid measure is a little more than a quart, liquid measure (1.06 quarts)

A liter, dry measure, is a little less than a quart, dry measure (.91 quart)

A kilogram is about 2⅕ pounds (2.201 pounds) avoirdupois.

A yard is about 91½ centimeters (91.44 centimeters)

An inch is about 2½ centimeters (2.54 centimeters)

A mile is about 1⅝ kilometers (1.61 kilometers)

A square yard is about ⅚ of a square meter (.84 square meter)

An acre is about ⅖ of a hectare (.405 hectare)

A cubic yard is about ¾ of a cubic meter (.76 cubic meter)

A quart, liquid measure, is a little less than a liter, liquid measure (.95 liter)

A quart, dry measure, is a little more than a liter, measure (1.101 liters)

A pound avoirdupois is a little less than half of a gram (.45 kilogram).



An old time country doctor s office

Medicine as a Career

By

Morris Fishbein, M D

Editor Journal of the American Medical Association

THERE was once a time when a boy who wanted to be a doctor needed little education He went through grade school and high school and then he studied with a doctor who was already in practice In those days there were very few women doctors for girls were not encouraged to enter this profession

After a while there began to be schools of medicine and by far the greater part of their students were young men At first only a few courageous women attended them but gradually the number increased In 1849 the first medical degree given to a woman in the United States was received by Elizabeth Blackmer from the Geneva Medical College This is now the Syracuse University College of Medicine The next year the first medical school exclusively for women was organized—the Woman s Medical College of Pennsylvania in Philadelphia This is still the only medical school in the country where all of the students are women

Let us see what kind of medical education prevailed in the middle of the nineteenth century It was not considered essential to go to college before entering one of those old time medical schools and it was fairly common for a young man to go to one directly from high school There he studied anatomy—that is the structure of the human body—and a little physiology which has to do with the way the body works and carries out its functions He also learned something about drugs many of which were taken on faith rather than because their worth had been scientifically proved The student attended examinations of the organs of dead bodies in order to see at first hand the changes that disease makes in human tissues Then he would see patients in clinics and he would go with a doctor already in practice to see patients who were ill in their homes

About the time when Pasteur discovered that germs cause disease, many of the other sciences upon which medicine is based began to make tremendous advances With this great increase in human knowledge a much longer course of study in medicine became necessary

Today the way is open for any boy or girl who wants to become a doctor In the United States there are many successful women doctors But any young student boy or girl has to look forward to a long period of training At the very least, he must have a grade school education a high school education and not less than two years of college education Three or four years are preferred, with a bachelor s degree at the end of them After that his real medical training begins First he must have four years of medical education After that he must have one year (and preferably eighteen months or two years) of an internship during which he sees patients in a hospital and helps the older doctors to take care of them Finally, if he wants to be a specialist, he must serve for three or more years as a resident in a hospital or as an assistant to a doctor already in practice

This is a long course of study For the student s parents it means a great deal of sacrifice Many young people by the time they are sixteen or eighteen years of age are able to work and earn money for the family The boy or girl who is looking for

ward to a medical career will have little time to earn money while studying He will be an expense to his family, which will have to pay the costs of his tuition in college and in medical school He will need money to buy books He will have to be provided with *clothing food and shelter This is a good* while for a young man to be dependent on his parents

Every year in spite of the time hard work and expense involved, great numbers of young men and a number of women decide to be doctors In fact more young people decide to undertake the study of medicine than can be accommodated in the medical schools This is probably a very good thing It means that the medical colleges may choose the men and women who seem to be best qualified for the study of medicine Because the medical schools limit their attendance, the number of graduates in medicine is seldom more than enough to meet the needs of the nation for doctors For this reason, the young man or woman who graduates from a good medical school and who is properly qualified can be reasonably sure of an opportunity to practice

The ideals of the medical profession have *been the same for thousands of years Medi*cine is one of the oldest of professions Dr Harvey Cushing most famous of brain surgeons, remarked that anyone with a good head, a good heart and skillful hands, who is possessed of a spirit of service who is not afraid of hard work and who will be satisfied with a modest income will find in medicine ample opportunity for happiness and for *the exercise of talents*



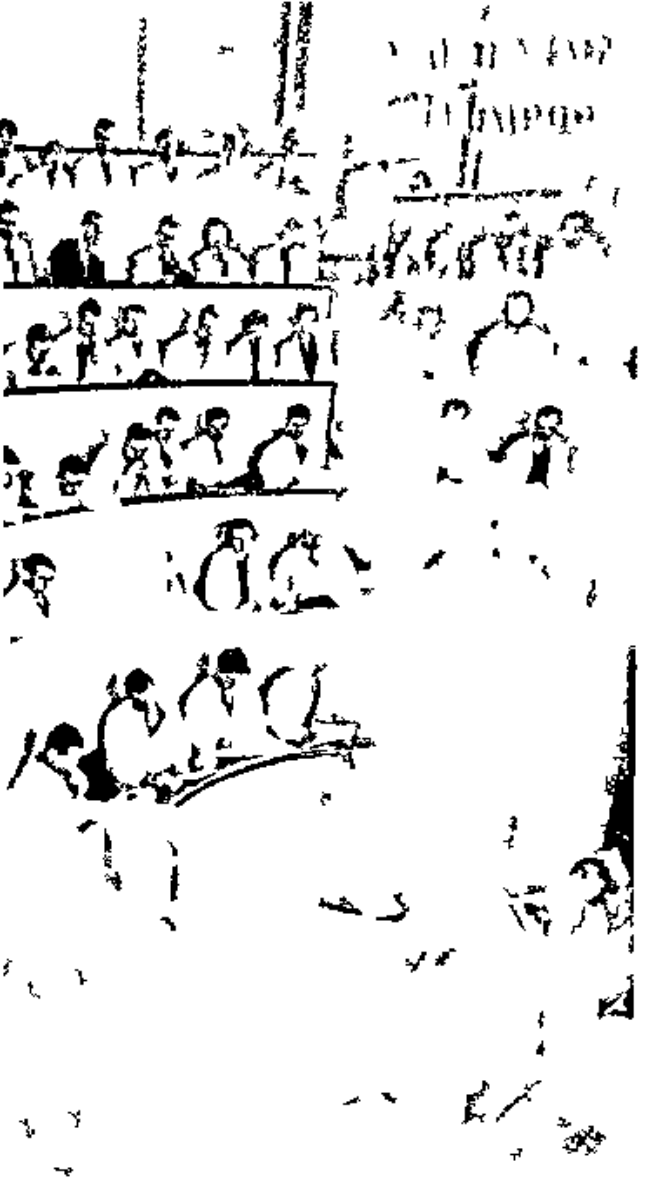
A doctor is a good and genial friend

Medicine today has become more exact and more scientific than the medicine of the past Physicians have always needed to win their patients faith and confidence and *even today such confidence is of great value* in achieving excellent results But nowadays a physician must also be skilled in the practice of highly scientific techniques in diagnosis and treatment The doctor is also a *health adviser It is his responsibility* to see that his patients understand how to live healthful lives with sufficient exercise and rest suitable diets and care in the selection of their occupations

Before a young person begins to study medicine it is customary for him to take some courses in science Both in high school and in college he should choose subjects which help to develop his scientific sense Biology physics and particularly chemistry are fundamental More recently mathematics, upon which the science of physics is so dependent has come to be recognized as equally vital to a medical curriculum Furthermore the young man or woman who enters medicine must learn to read easily *such languages as French or German or* more recently Spanish He must be well grounded in Latin The ability to express one s self well is fundamental to success in medicine so courses in English grammar *and composition and even in the ability* to stand on one s feet and speak are required

Once the student reaches the study of medicine, he concentrates particularly upon anatomy physiology, pathology and pharmacology Anatomy offers him the chance to grasp a thorough understanding of the structure of the normal human body He studies this structure as it can be seen by the naked eye and he also studies the structure of the tissues of the body as seen through powerful microscopes

The physiologist of an earlier day was concerned with the *simple reactions which* enable us to see and to hear and feel and move. He was taught the actions of the lungs in breathing, of the blood in providing nutriment to the body of the digestive tract *in assimilating digesting and selecting from* food the important ingredients Today, however, the young student of physiology has



The New York Hospital

The theater of a medical school where students see great doctors and surgeons at work.

much more to learn about this subject Among other things he learns about the innumerable cells that make up the blood the reactions by which the blood clots when there is bleeding and the way in which the blood attacks infectious diseases He studies the chemistry of proteins and the way in which the liver stores sugar He learns how the bile is created and its function in the body The physiologist has mapped out the various areas in the brain which are responsible for thinking, for causing an arm or a leg to move, and for co-ordinating what the eye sees with the action of the hands

One hundred and fifty years ago medicine depended principally upon the botanic garden for its remedies From these gardens came digitalis which is still a supreme remedy for the heart quinine which is a specific for malaria and belladonna from which in turn, came atropine Pharmacology today has advanced far beyond these simple beginnings In modern chemical laboratories elements and derivatives of coal tar and many other substances are put together to make such drugs as aspirin amidopyrine and acetanilid and the sulfa drugs From the synthetic chemical laboratory come sedative drugs which stop convulsions relieve pain and produce anesthesia A far cry from the old botanic gardens are modern biologic remedies and preventive materials such as the antitoxins against diphtheria the vaccine used against smallpox and the inoculations against mumps and scarlet fever And, finally as the great triumph of modern medicine we have the wonderful new antibiotics These include penicillin and streptomycin which are the secretions of living molds The antibiotics prevent the growth of certain deadly germs In this way they exert potent effects against infectious diseases.

It was once thought that all disease was an expression of some action of a higher power on man Gradually physicians learned that diseases rose from specific causes Pasteur showed that there are germs which are responsible for infectious diseases From these studies came the science of bacteriology To day every medical student must learn the fundamentals of this science Related to the development of bacteriology are immunology and serology and the development of the specific biologic remedies and the antibiotics

Man must eat to live We have learned however that as civilization has developed man sometimes fails to secure certain necessary substances in the diet A deficiency of certain vitamins or of certain mineral salts or proteins in the diet leads to deficiency diseases For instance a lack of vitamin C is associated with scurvy a lack of vitamin A with disturbances of the eyes and of the skin a lack of thiamin leads to beriberi or neuritis and a lack of vitamins A and D or of calcium and phosphorus results in rickets This knowledge helped to develop the new science of nutrition which has its basis in physiology Nutrition has become a vital part of the study of medicine

Certain diseases are definitely related to the failure of some of the tissues of the body to carry on their normal activities The pancreas gives us an example This gland is concerned with the way in which the body uses sugars If the pancreas fails to act properly, a substance called insulin must be artificially supplied The insulin does the work which the pancreas should do

As medicine grew new techniques were in

troduced for diagnosing disease Most impor tant of these was probably the use of the \ ray But long before the \ ray medical science had begun to help the doctor look into the various cavities of the body Special instruments were developed to observe each portion of the body until today there is a different one for every opening The instru ment used to look into the throat is called a laryngoscope The otoscope is used for the ear and the ophthalmoscope for the eye Many instruments which help you to ob serve or which give you a better view are given names ending in scope You are fa miliar with this suffix in the words microscope and telescope It is derived from the Greek word *skopos* which means watcher

The growth of medical knowledge has be come so great that it is no longer possible for a single physician to know everything that ought to be known about diagnosis and treatment as it affects every portion of the body and every group of diseases Medicine today is not just one subject but a great group of specialties These include surgery internal medicine dermatology (which deals with diseases of the skin) nervous diseases mental diseases diseases of the stomach and intestines diseases of the brain diseases of the heart tuberculosis orthopedic surgery (which deals with deformities and disabili ties of structure) preventive medicine and public health roentgenology (which deals with the use of \ ray and radium) anesthe sia and industrial medicine Each of these in turn may be divided into a number of other specialties making altogether innumer able careers that beckon the young man who feels that medicine is his chosen calling

The many things that a doctor must learn should not frighten any young person who wants to study medicine He needs only to remember that thousands of students before him have successfully coped w th the medi cal curriculum and later entered on the prac tice of medicine All that a doctor needs to know is not learned only in medical school or even in a hospital thereafter Medicine is a lifetime study Leaders in the field of medi cine are organizing courses of study for med ical graduates so that they may go back at





Top Columb a Col ege of P s c ans and Su geo n Cen e In l Ia ke ph o \ oc a ed ll p al serv e of \ \ R ab The New \ rk Ho p al

Work in a medical laboratory offers an interesting career

Examining a bit of diseased tissue helps to diagnose the illness.

Studying the action of drugs in a pharmacy laboratory



The New York Hospital

The theater of a medical school where students see great doctors and surgeons at work.

much more to learn about this subject Among other things he learns about the innumerable cells that make up the blood the reactions by which the blood clots when there is bleeding and the way in which the blood attacks infectious diseases He studies the chemistry of proteins and the way in which the liver stores sugar He learns how the bile is created and its function in the body The physiologist has mapped out the various areas in the brain which are responsible for thinking for causing an arm or a leg to move and for co-ordinating what the eye sees with the action of the hands

One hundred and fifty years ago medicine depended principally upon the botanic garden for its remedies. From these gardens came digitalis which is still a supreme remedy for the heart quinine, which is a specific for malaria and belladonna from which *in turn, came atropine Pharmacology today* has advanced far beyond these simple beginnings In modern chemical laboratories elements and derivatives of coal tar and many other substances are put together to make such drugs as aspirin, amidopyrine and acetanilid and the sulfa drugs From the synthetic chemical laboratory come sedative drugs which stop convulsions relieve pain and produce anesthesia A far cry from the old botanic gardens are modern biologic remedies and preventive materials such as the antitoxins against diphtheria the vaccine used against smallpox and the inoculations against mumps and scarlet fever And finally as the great triumph of modern medicine we have the wonderful new antibiotics These include penicillin and streptomycin which are the secretions of living molds The antibiotics prevent the growth of certain deadly germs In this way they exert potent effects *against infectious diseases*

It was once thought that all disease was an expression of some action of a higher power on man Gradually physicians learned that diseases rose from specific causes Pasteur showed that there are germs which are responsible for infectious diseases From these studies came the science of bacteriology Today every medical student must learn the fundamentals of this science Related to the development of bacteriology are immunology and serology and the development of the specific biologic remedies and the antibiotics

Man must eat to live We have learned however that as civilization has developed man sometimes fails to secure certain necessary substances in the diet A deficiency of certain vitamins or of certain mineral salts or proteins in the diet leads to deficiency diseases For instance a lack of vitamin C is associated with scurvy a lack of vitamin A with disturbances of the eyes and of the skin a lack of thiamin leads to beriberi or neuritis and a lack of vitamins A and D or of calcium and phosphorus results in rickets This knowledge helped to develop the new science of nutrition which has its basis in physiology Nutrition has become a vital part of the study of medicine

Certain diseases are definitely related to the failure of some of the tissues of the body to carry on their normal activities. The pancreas gives us an example This gland is concerned with the way in which the body uses sugars If the pancreas fails to act properly, a substance called insulin must be artificially supplied The insulin does the work which the pancreas should do

As medicine grew, new techniques were in

Mexico



Pictures Courtesy Coordinator of Inter American Affa

The beautiful Palace of Chapultepec in Mexico City was the meeting place of the Inter American Conference

By Samuel Guy Inman

Author of Latin America Its Place in World Life

THE palace of Chapultepec in Mexico City stands on a high bluff which the Aztecs called Grasshopper Hill The famous palace has a magnificent view of the Mexican capital From the portico you can look down a wide avenue lined with statues, flower gardens and beautiful buildings This avenue reaches to the central plaza with its great cathedral Far beyond rise the snowy summits of two of the most famous mountains in America, affectionately called Popo (Popocatepetl) and Ixtle" (Ixtaccihuatl)

The rambling old castle was begun in the eighteenth century At one time it was the residence of Maximilian, the Austrian prince who was sent to Mexico as emperor' by Napoleon III of France and other dreamy adventurers

Chapultepec has had a stormy history Long before the coming of the Spanish conquerors, the early Aztecs chose Grasshopper Hill as a fortress and a bulwark Later, it became a favorite resort of the Aztec emperors In 1519 the height was stormed by the Spaniards under Cortes Just about a century ago, Chapultepec was taken by United States troops under General Scott

In 1945, Chapultepec became more famous than ever From February 21 to March 8 the palace was used as a meeting place for the representatives of almost every American republic This meeting is usually spoken of as the Mexico City Conference Officially it is called the Inter American Conference on Problems of War and Peace

The story of Chapultepec served as a reminder to the delegates at the Mexico City Conference It helped them to understand how proud Mexico is of her liberty for which she had fought so many times American nations know what it means to struggle for freedom At that very moment many of them were fighting for their lives against Germany and Japan

The Mexico City Conference was the most successful inter American conference ever held The good feeling at the conference was partly the result of lessons learned from the war, when co-operation was vital to the safety of all America

Mexico's Minister of Foreign Affairs was elected president of the conference His name is Ezequiel Padilla and he has long been known as a strong supporter of Pan Americanism

In his opening address, Padilla talked about the millions of Latin Americans who are extremely poor

One of the great hopes of the conference was that more ways could be found to help the common people of Latin America More industries and more factories would bring greater prosperity to the southern republics The United States promised to help build these factories The people would be paid more money for working in factories than

frequent intervals—some of them every year some of them at three to five year intervals or longer—to bring themselves up to date with all of the new knowledge that medicine acquires year by year

Before deciding to take up a medical education you should know whether or not you have any real aptitude for medical science Perhaps the actual practice of medicine may not appeal to you as much as work related to the medical field There are several careers that do not demand a medical diploma or a medical license but which give opportunity for association with medical work There are opportunities for careers as medical laboratory technicians, X ray technicians physical therapy technicians anesthetists hospital superintendents social service workers and public health workers Men who have had many years of experience in teaching medical students can recognize certain qualities that fit or disqualify a student for actual practice If you will talk to them they can help you make a wise decision

If you qualify you will then have to choose a medical school You can write to the Association of American Medical Colleges or to the Council on Medical Education and Hospitals of the American Medical Association and they will send you a list of the schools with the necessary information about them

The cost of a medical education varies so much that the total average expense to students for a year may be anywhere from $900 to $1,500 This includes the tuition and the fees board and room, medical books instruments and medical journals, travel insurance interest on funds and recreation The fees in medical schools vary from around $50 a year to $500 a year Every good medical school spends more on the student than he pays into the school The average cost of maintaining medical schools is approximately $705 per year per student whereas the average of fees paid by students is $255 In some schools the cost per student per year is more than $3 000

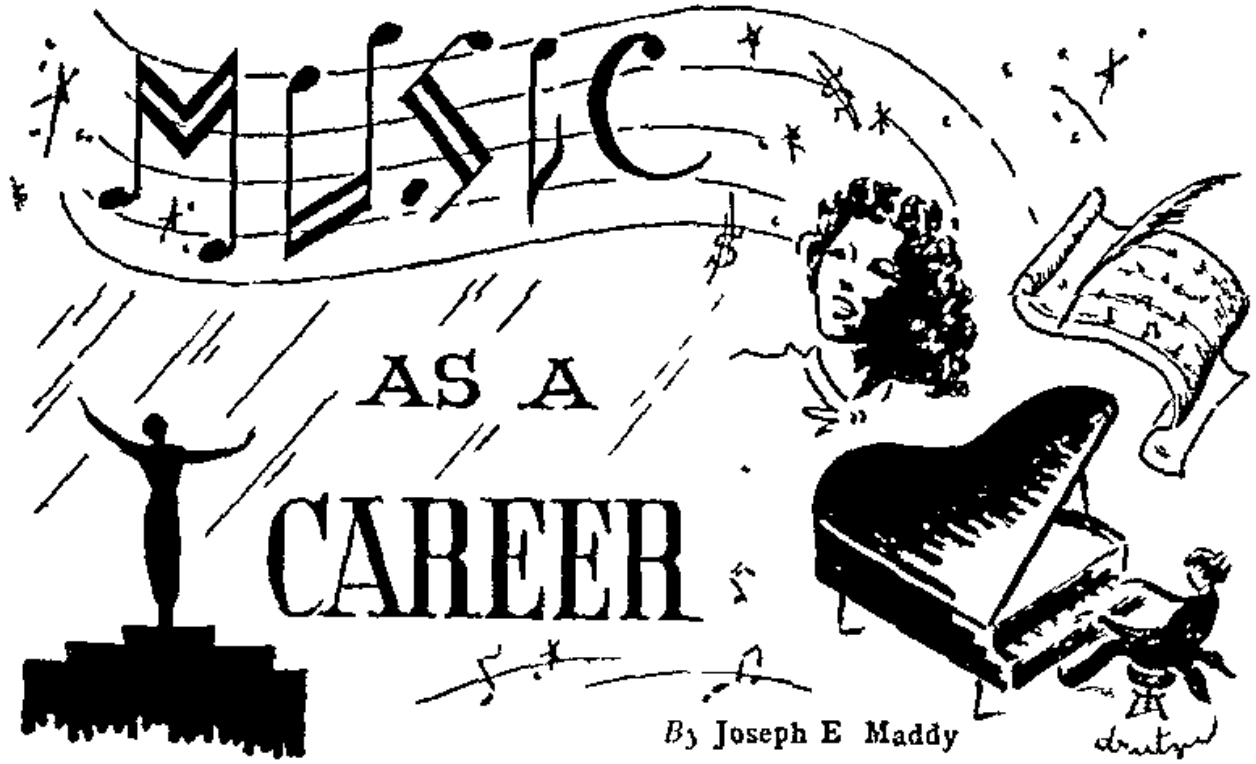
After the student graduates he must serve an internship and he must submit himself to a state licensing examination And he must put in a good many more years if he wants to be a specialist In spite of all this, a career in medicine will yield great returns in the way of satisfaction and in the way of opportunity to help mankind

No writer has better understood the fine qualities of the good physician than Robert Louis Stevenson who called him the flower of our civilization



Davis and Geck, Inc.

While a surgeon operates student doctors watch. Doctors and nurses all wear sterilized robes and masks to help keep the operating room as free from germs as possible



AS A CAREER

By Joseph E Maddy
President National Music Camp

HOW much do you love music? So much that you would rather study it and perform it than do almost anything else? If you are planning to choose music as your career *you should be able to give just one* answer— Yes!

Equally important is the question how much musical talent do you have? A good deal of talent is necessary for success as a musical *performer or teacher or composer* A competent music teacher can help you to find out *whether* or not you are *musically gifted* If you have just a little talent along with a great love of music, the combination can give you much pleasure, but it is not going to get you very far as a professional musician Unless *your talent is above average, music* should probably remain for you what it is for so *many* people—a favorite *hobby* and a lifelong joy

Let us suppose that you are musically gifted and that you have an irresistible urge *to develop* your talent Then it will pay you to know as much as you can about the *variety* of opportunities that music has to offer In *music* you can find for yourself a highly respected profession, as well as many side lines by which you can earn a little extra money Music also offers you rest and relaxation after a day of hard work

Here is an example of what I mean At one time I was head of a conservatory of music and I also taught music in a high school At the same time I was a *retail music dealer* and a conductor of the local symphony orchestra *and municipal band* All of these things kept me pretty busy and I had to have some recreation, just as you will need to do So I relaxed and enjoyed myself by playing in a string quartet

The *fields of music may be roughly divided* into musical performance teaching and creating Two *fields* allied to these are manufacturing and selling Musical performance is a very popular field and it may appeal to you more than the others do especially if you are happiest when you are playing or *singing* But *one* of its attractions is unreliable for you to follow Do not choose this *field just because some top artists earn enormous* sums of money in radio work, motion pictures the opera, recording and other forms of entertainment. Very few musicians become glamorous stars or make a *fortune* through their music

Perhaps I can give you an idea of why it is so *difficult to reach top rating in the entertainment* field First the musician must have a rare combination of qualities—not only exceptional musical talent but also a high degree of dramatic talent unbounded energy and perseverance And that is not all that

they would get for farm work They would have more goods at home and they would be able to buy more goods from the United States By helping each other in this way the United States and Latin America would both become more prosperous

Many agreements were made at the conference The most famous one is called the Act of Chapultepec This act was a wartime measure and guaranteed an alliance of the American nations against aggression The act also provided that a treaty should be drafted to keep this guarantee in force after the war was over

It is interesting to compare the Act of Chapultepec with the Monroe Doctrine of the United States According to the Monroe Doctrine it is the policy of the United States to oppose any country that attacks any of the American nations This is what is called a unilateral policy that is it is one sided Now by agreeing to the Act of Chapultepec all of the countries of Latin America have joined with the United States in a promise to aid each other against attack This is called a multilateral (many sided) policy

Another important achievement of the Mexico City Conference was the reorganization and strengthening of the Pan American Union In the past the President of the United States has been the president of the Union and the Secretary of State of the United States has been its director In the future these two offices will be held by members of the various republics of America

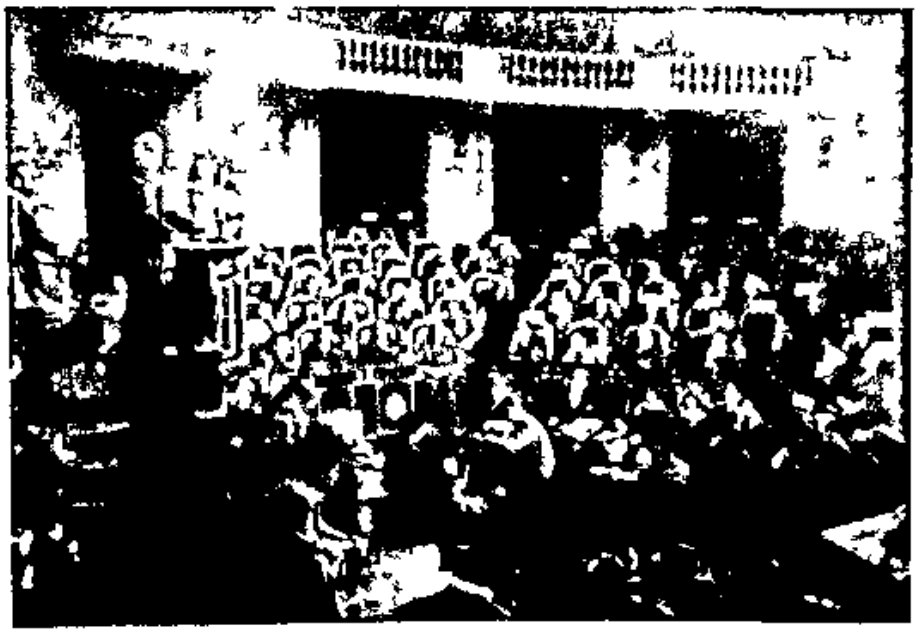
The Pan American Union was asked to watch over the whole continent to try to settle quarrels before they can lead to war, to try to improve trade to further the exchange of students and to strengthen the friendship of all American peoples

Although Argentina was not present, she signed the Act of Chapultepec shortly after the conference

Election campaigns aroused great interest in Mexico in 1945 President Manuel Avila Camacho promised that a presidential election would be held in July 1946 You have already met one of the chief candidates—Senor Ezequiel Padilla who presided over the Mexico City Conference Not long after the conference adjourned Padilla resigned from his office as Minister of Foreign Affairs. The new minister is Dr Francisco Castillo Najera Padilla was very popular in the United States because he tried to bring the southern republics into closer co-operation with it All during the war he used his great influence to this end

Elections in Mexico are much more democratic than they used to be and this progress is greatly to her credit But to further the growth of democracy people need to know how to read and write

Mexico has begun a campaign to wipe out illiteracy Each educated Mexican citizen must take one illiterate person as a pupil and teach him reading and writing A law was passed to make sure that this is done The movement is nation wide and has been well organized by the Secretary of Education. The enthusiasm that is being shown in this work holds out the promise of changing the life of the whole country for the better



Edward R. Stettinius, then American Secretary of State outlining the foreign policy of the United States to the delegates at the Inter-American Conference

is required—not by any means

An opera singer for instance must have an unusually good memory If the opera is your goal you will have to learn by heart the music words and action to literally dozens of long operas—*in at least four languages* You will need a strong healthy body for a slight throat trouble or other physical illness may interrupt or even end a singer s career To charm an audience a singer must have a pleasing personality A singer s personality often spells the difference between failure and success In addition to all of these assets a successful opera singer must have a magnificent voice

Before you could sing in the opera or on the concert stage you would have to go through a long period of training The expense is usually very great whether you study in music schools or with private teachers at home or abroad The concert singer as well as the opera singer must learn French, German and Italian because the words of so many songs and of so much operatic music are written in those languages What better place could you find in which to learn a language than the country in which it is spoken? And where could you absorb the background of the songs better than in the countries where they were written? There is no doubt that it is an advantage to be able to go abroad at some time in your training, but right now some of the greatest teachers of voice are here in North America

There is one general rule If you wish to become a great singer and if you have the qualities which a great singer must possess then you deserve the very best training possible

An instrumentalist is a person who plays an instrument such as a flute clarinet or violin Many a young musician looks forward to the day when he will be a concert violinist or other instrument player A long period of training will lie ahead of him before that day finally arrives He must practice tirelessly and develop a deep understanding of the music which he is to perform in order to interpret it to the audience

One dream of the young instrumentalist is to become a member of one of the great symphony orchestras If this is your goal you will find that it will give you a better living today than it did only a short time ago Until recently the usual symphony orchestra season was so short that many instrumentalists



The lovely music of the violin rewards the student for long hours of practicing



National Music Camp

Students enjoy playing in orchestras at school and in music clubs



Metropolitan Opera stars Salvatore Baccaloni and Erio Pinza in Rossini's 'Barber of Seville.

Courtesy Metropolitan Opera



Scene from Mozart's opera 'The Magic Flute'

standing original musical works the most coveted award being an annual $25 000 prize by Rudolph Reichhold of Detroit for the best symphonic composition by an American

In general, however, the field of composition, while it has the most to offer as a form of self-expression, is the least promising in its financial rewards The average musician turns to original composition, not as a means of earning a living, but as a hobby or as a side line

Contrary to what you may have heard, the composer of so-called popular or tin pan alley' songs is more likely to starve than to get rich from his efforts The best songs may never become popular if they do not have the backing of established publishers to plug' them Publishers have their own song writers whose songs they try to make popular A publisher who spends thousands of dollars 'building up' a song writer's reputation is not likely to shift his efforts to promote a single song by an unknown writer, even though he may like the song

Manufacturing and publishing are necessary for the musical progress of the nation and of the world and America has at last taken the lead in these fields New and greatly improved musical instruments, which will revolutionize musical performance in due time, have been developed recently in sound laboratories Better radios wire recording and reproducing machines, electronic musical instruments and instruments of light metal or of plastic are some of the products of American genius and manufacture

During the war, manufacturers of musical instruments turned to the manufacture of precision war products. The new skills and broader vision which they developed will surely result in better and cheaper musical instruments of all types than can be produced elsewhere in the world Plastics and light metals may take the place of wood and bamboo in making the woodwinds and stringed instruments as soon as American genius has a chance to work in this field

Music selling is a field with ever growing opportunities for the music dealer now finds his products advertised through radio and motion pictures and he has new lines of merchandise related to radio, recording and television

The music store is the natural place to sell radios, recording machines, television receivers and similar products With these popular kinds of musical merchandise, a wide awake music dealer can have a thriving business in a community too small to support the old kind of piano and sheet music store

While there are some people who believe that radio and the sound movie have seriously hurt the opportunities for musicians in this country, the fact remains that there are more fully employed musicians receiving higher incomes in America today than ever before There are millions of children in our schools and colleges who are learning to become good musicians and who are buying music. There are other millions who have learned to appreciate music through radio All these are creating a greater market for everything musical than the world has ever known before.





by the war Sibelius said that he was merely in the same boat as the rest of his fellow Finns

Europeans found it almost impossible to buy musical equipment and so among the gifts sent to Europe by Americans during the year was a shipment of strings reeds bows trumpet mouthpieces and other things of that sort This gift was made to the Leningrad Philharmonic Orchestra by members of the Philadelphia Orchestra through the Russian War Relief Since August 1941 the Leningrad Philharmonic has traveled throughout Russia

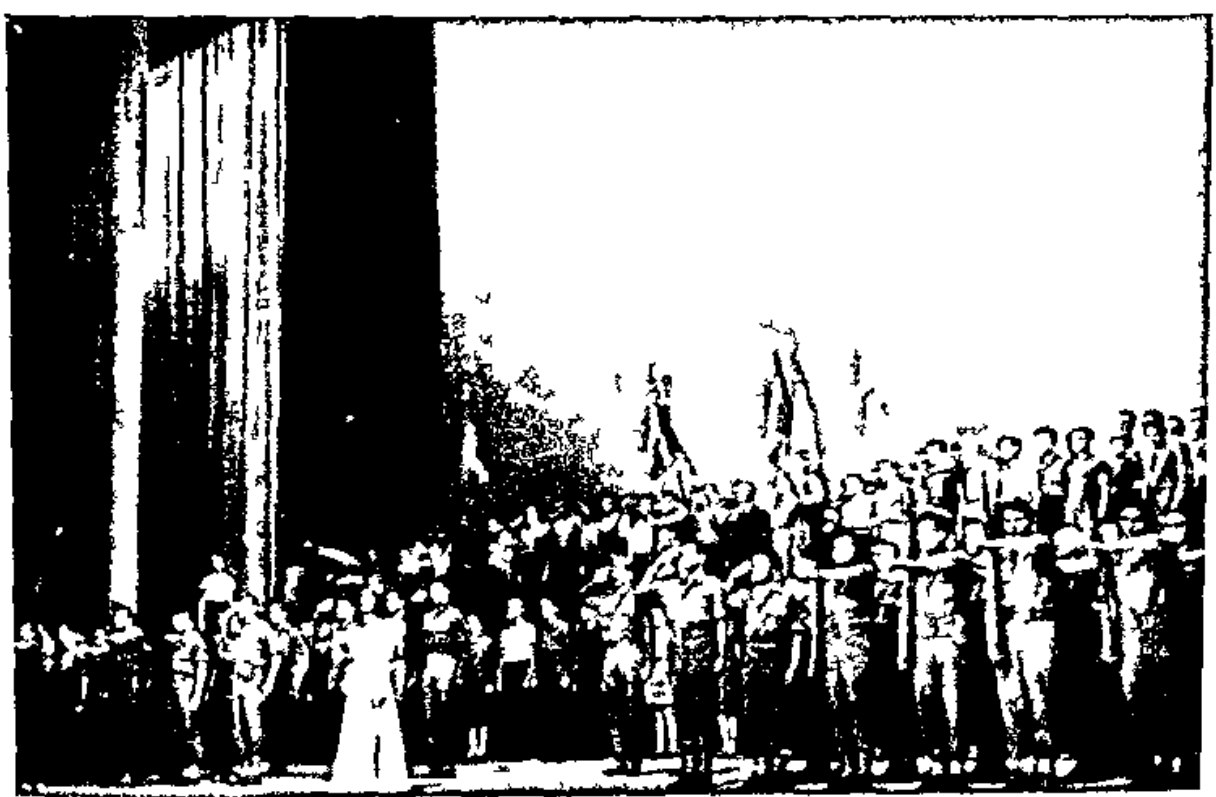
In the United States a number of war casualties came to life again Prominent among them were the Worcester (Massachusetts) annual Fall Festival and the Detroit Symphony Orchestra Walter Howe was the new director of the Worcester Festival succeeding the late Albert Stoessel Henry H Reichhold an industrial chemist of Detroit generously helped the Detroit Symphony to get back on its feet Mr Reichhold also sponsored a series of broadcasts over a national network Karl Krueger formerly director of the Kansas City Symphony was the conductor of the Detroit Symphony

The managers of eighteen major symphony orchestras of the United States held their annual meeting in May Altogether the eighteen orchestras employ 1 513 musicians

Three hundred and eighty five former members have been in the armed services and 210 of the players are women

The financial report of these orchestras may interest you because it shows how orchestras meet their expenses Gifts of money are very important in paying these costs The orchestras had a combined gross income of $3 827 639 The operating expenses were $5 558 589 This left a combined deficit of $1 730 950 which was offset by gifts from philanthropists and friends of the orchestras amounting to $1 758 502, yielding a combined surplus of $27 552 People who attend the orchestral concerts and the radio sponsors and broadcasters who pay for the privilege of putting them on the radio pay 69 per cent of the cost of operating the orchestras a little more than two-thirds and 31 per cent of the cost is raised by gifts

Four young singers won awards from the Metropolitan Opera Association in New York as a result of its annual radio contest In 1945 the auditions were renamed The Metropolitan Opera Presents The winners were Robert Merrill baritone of Brooklyn



French Press and Information Service

This scene on the stage of the famous Paris Opéra is dramatic but not make-believe. *Lily Pons, coloratura* is singing at a celebration of the first anniversary 1945, of the freeing of Paris on August 25, 1944.

Musical Events

By

John Tasker Howard

MANY of the famous music festivals orchestras and opera houses of Europe were abandoned during the war But as soon as victory was won in Europe American troops helped the liberated peoples take up some of their music activities again The annual festival in Salzburg Austria which had not been held since 1939 was given in August Two American soldiers were among the conductors who led the orchestral concerts and the performances of Mozart's opera *Die Entfuhrung aus dem Serail* which were given in the Municipal Theater

In Italy Staff Sergeant Hans Busch son of Fritz Busch the noted conductor staged four operas in the Teatro Verdi in Florence He served also as stage director at the Opera Reale in Rome and supervised the repairing of La Scala the world famous opera house at Milan La Scala had been badly damaged by bombs in the spring of 1943 and the Italian people had refused to repair it while the Fascists and Nazis were still in control Once the enemy was driven out the people of Milan went to work eagerly They were greatly helped by a gift of a million lire from Mrs Wally Castelbarco daughter of Arturo Toscanini Toscanini had refused to return to Italy when it was under fascist rule but in 1943 he accepted an invitation to conduct at La Scala

During the German occupation the people of Paris found that music was a solace At first the Parisians felt that they should drop all public music activities Then they realized that if they did not run their own opera houses and concert halls the Germans would take entire control of the musical life of the city So, as much as they dared the Parisians insisted that French artists and French musical programs be given a leading place They succeeded fairly well even though the Nazis did away with many performers and works that were not Aryan Mendelssohn's works were forbidden and no all Russian programs were allowed

French music lovers worked under great difficulties but the result of their efforts was well worth while The theaters were all in good shape at the time of France's liberation and the regular organizations were in working order The few persons who had been in sympathy with the Germans were of course removed after liberation Both of the opera houses—the Opera and the Opera Comique—became popular with American soldiers and officers Four well known orchestras in Paris—the Conservatoire the Colonne the Lamoureux and the Pasdeloup—gave regular subscription concerts on Sunday afternoons Even though all four of these orchestras were playing on the same afternoons all of them drew large audiences

One incident that took place during the year concerns the great Finnish composer, Jan Sibelius Knowing that the eighty year old composer was no longer receiving American royalties (payments) for the performance of his works, the Philharmonic-Symphony Society of New York sent him $1 000 as a way of thanking him for the many great pieces of his music that it had been privileged to play At the time, Sibelius was living in his country home a few miles from Helsinki When a New York newspaper man telephoned him after the announcement of the gift and asked how he had been affected

by the war, Sibelius said that he was merely in the same boat as the rest of his fellow Finns.

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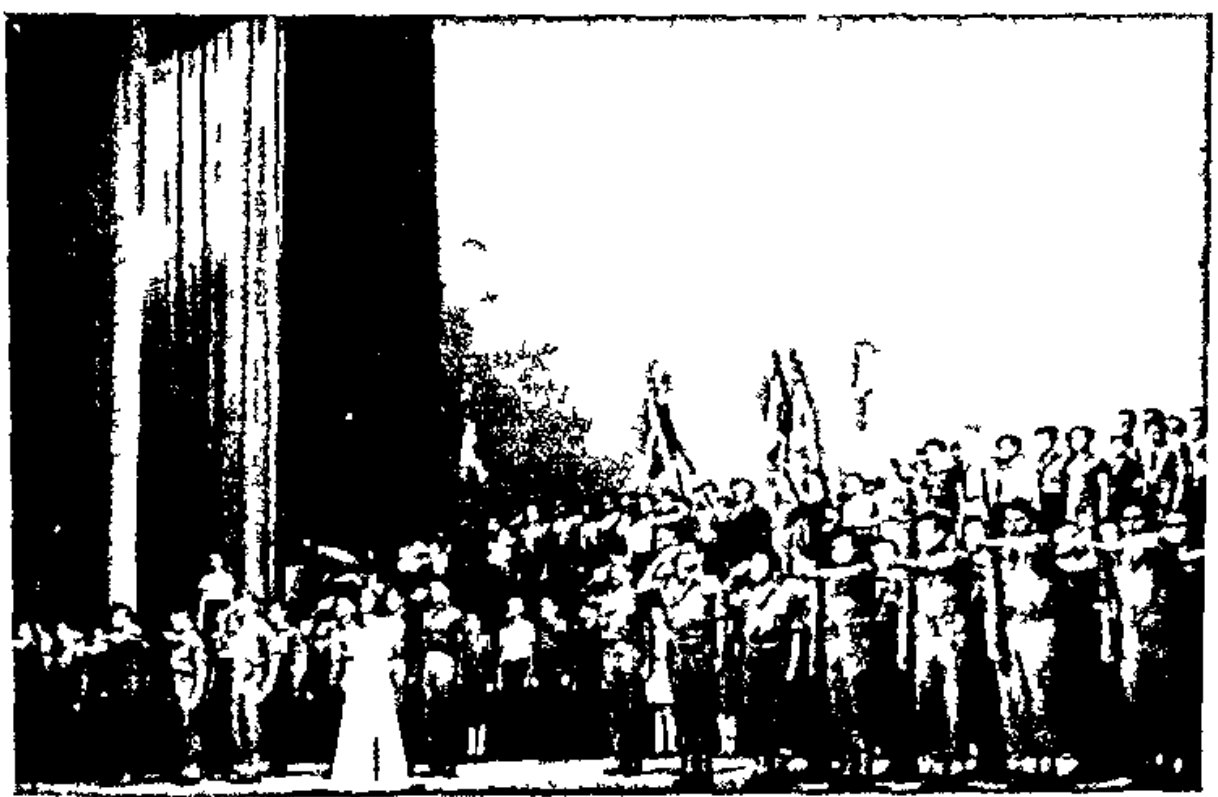
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Keystone Press and Information Service

This scene on the stage of the famous Paris Opera is dramatic but not make-believe Lily Pons, coloratura, is singing at a celebration of the first anniversary 1945, of the freeing of Paris on August 25, 1944.



Courtesy Mus cal Cour er

Melchior and a guardsman in Copenhagen Denmark. The tenor sang for King Christian s birthday

New York and Thomas Tibbett Hayward, tenor, of Kansas City Each was given a check for $1 000 and a contract for the following season Joseph Victor Laderoute, tenor, of Sault Ste Marie, Ontario, and Pierette Alarie, soprano, of Montreal, were given $500 scholarships

Leonard Bernstein, the young musician who achieved sudden fame at the age of twenty five when he substituted for Bruno Walter as conductor of the New York Philharmonic Symphony (November 14, 1943), has been adding to his successes Late in 1944 his JEREMIAH symphony was voted the best orchestral work by an American to be played in New York during the preceding season, and his ballet FANCY FREE, was produced by the Ballet Theatre at the Metropolitan Opera House where it played to "sold out" houses On December 28, 1944, a musical comedy—ON THE TOWN—based on FANCY FREE with music by Bernstein was produced at the Adelphi Theater in New York It soon became one of New York's hit shows ON THE TOWN was later moved to the Martin Beck Theater, where it was still playing to capacity as 1945 ended

Two young artists, both from Ohio, were winners in the 1945 auditions of the National Federation of Music Clubs, held May 24 1945 in New York One was 21 year old Paula Lechner, dramatic soprano, who trained at the Cincinnati College of Music and the other was 23 year old Eunice Podist (Mrs Robert Weiskopf), of Cleveland Heights Ohio Each was awarded $1,000, and appeared on September 23 as soloists with the NBC Symphony on the General Motors Symphony of the Air' program Frank Black was the conductor

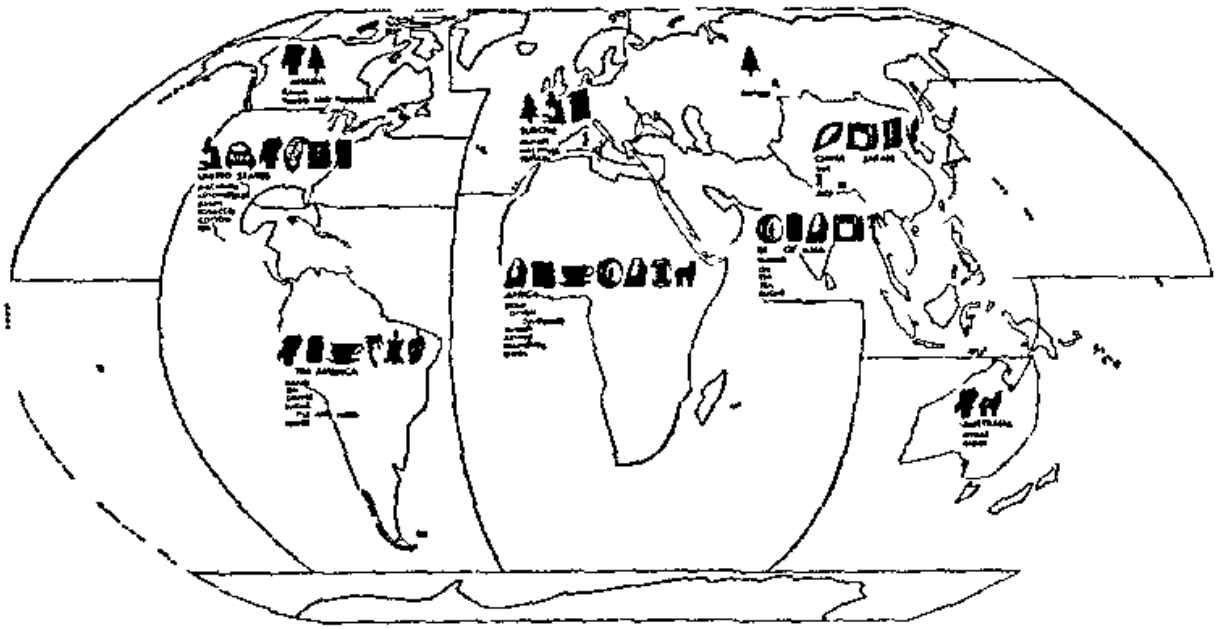
ARTIE SHAW WANTS YOUNG PEOPLE TO LISTEN QUIET, PLEASE!

Artie Shaw, the popular bandleader, declared that 'hot' music was not so good in 1945 as it had been at the beginning of the war Many new songs were very poor stuff, but nevertheless they were sold and sung A lot of incompetent bandleaders," said Shaw 'have found a market for mediocrity in the wartime appetite for popular music' Shaw was particularly scornful of the "common practice of encouraging screaming shrieking and swooning, and mass hysteria among young people" What would happen he asked, if, during Beethoven's NINTH SYMPHONY, neither the conductor nor the audience could hear the music for the shouting and the swooning?

Frank Sinatra, the well known singer of hit songs, left the Saturday night 'Hit Parade' program, on which he had been the regular featured soloist, and was succeeded in January, 1945 by the opera and concert star, Lawrence Tibbett Tibbett estimated that in a single season on this program he would sing about 200 different songs

Kirsten Flagstad, the Norwegian soprano had been one of the leading stars at New York s Metropolitan until she returned to Norway in 1941 Mme Flagstad announced that she would come back to the United States to see her daughter, who lives in Montana, if not to sing During the German occupation Mme Flagstad lived in Norway with her husband, Henry Johansen

Four well known musicians who died during 1945 are Erno Rapee, music director of the Radio City Music Hall, New York (June 26), Nicolas Tcherepnin, Russian composer (died in Paris, day and month not known) Pietro Mascagni, Italian composer of CAVALLERIA RUSTICANA (August 2) and Jerome Kern, composer of OL' MAN RIVER and of many hit musical scores including SUNNY, ROBERTA and SHOW BOAT (November 11)



From Explo ng he Wo d of Geography publ shed by Harcourt Bra e & Co Inc

The symbols represent the chief products which each region contributes to the world exchange of goods.

Nations in World Trade

By **Graeme O Geran**

YOU often hear it said that this is the age of specialization People devote themselves entirely to particular jobs so that perhaps your father makes shoes a next door neighbor may turn out a small but important part of an automobile, while your uncle may own a farm and raise fresh lettuce radishes and onions for the near by city

This division of labor first began to appear in Europe during the fourteenth and fifteenth centuries when great landowners commenced the practice of renting land to tenant farmers Before that time each estate or family grew and manufactured most of the goods necessary to its needs There was little trade except in a few goods such as salt and iron which could not be found in every neighborhood But aside from the purchase of such commodities each manor or estate was largely self sufficing

As the great landowners rented out more and more of their land and the great estates declined in size number and importance workers guilds came into existence and rapidly grew First came the merchant guilds which devoted themselves to trade As the demand for goods expanded craft guilds were created each specializing in the making of some one product as boots and shoes bakery goods cloth or iron products

As trade and commerce grew so did the demand for goods and soon producers were looking for new and speedier ways to create commodities. This brought about the Industrial Revolution of the eighteenth and nineteenth centuries As we know many machines were invented in those centuries to do the work of many men and do it much more efficiently Steam took the place of man power and animal power Labor was divided still further Instead of making a pair of shoes from start to finish a man tended a machine that turned out a single part of the shoes but did it very fast. This resulted in the creation of many new commodities in much less time and at a greatly decreased cost for labor Lower costs meant lower prices. Lower prices meant that more people could afford to buy shoes for instance The demand for things increased all over the civilized world More and more people began to make things for each other the division of labor had come to stay and buying and selling had become a major industry

Our old friend Robinson Crusoe on his island did everything for himself (at least until Friday came) so that neither division of labor nor trade entered into his experience However imagine a hundred people living on an island As soon as they began to divide their labor among different occupa

tions, the need for exchange would spring up

One man would make a weapon, and exchange it perhaps for a fish caught by another, or for some grain grown by a third *That would be a simple exchange of goods*—we call it barter When you exchange a pocket knife for some marbles, you are bartering In early times, even in this country most trade was conducted in the same manner Today, to a very limited extent, barter is still used, as when a farmer brings a crate of eggs to a village store and in exchange receives from the storekeeper flour or sugar During the depression days of the early 1930's in the Middle West of the United States, farmer boys who wanted very badly to go to college, but had no money, would sometimes pay their tuition in bushels of *corn or potatoes*

The system of barter is very inconvenient and cumbersome Suppose, for example, that an opera singer needs a new costume She doubtless would have difficulty in finding a shopkeeper who would be willing to exchange a dress for a song The problem would immediately arise (assuming the merchant was willing to make such an exchange) as to how long she must sing, or how many songs must be sung, to pay for the dress This same situation would repeatedly arise as the musician sought to exchange her talent for other goods and services

Such a system of barter today would compel every merchant to list the exchange or barter value of every article in the store for every other article that everyone else might have to sell He would scarcely have room on his walls or ceiling for such a price list It is very clear that under such limitations trade and commerce as we know it today would be utterly impossible

MONEY AS A MEDIUM OF EXCHANGE MAKES WORLD TRADE POSSIBLE

Very early it was realized that some other method of transfer had to be invented, a "common denominator" had to be provided for the purpose of measuring and stating values So, instead of saying that a hat is worth so many pounds of sugar, or so many pairs of socks, we price all of these things in *money* We say a hat costs so many dollars, and sugar so many cents a pound With enough money in their pockets people can buy whatever they wish, so they are very willing to exchange their commodities for your money Today trade is greatly simplified through the universally acceptable commodity—money

Trade is exceedingly important, for it takes a thing from where it is made to where it is needed, and until a thing can be placed in the hands of a person who wants or needs it, it has not really become useful This is a *very important fact in economics It may* be said with truth that wealth is matter in the right place at the right time, and the matter can be gotten into the right place at the right time by some means of exchange

GOODS HAVE EXCHANGE VALUE ONLY WHERE NEEDED OR DESIRED

We can remind ourselves how important it is to transfer things from places where they are not wanted to places where they are wanted by a very simple story Some winters ago a college made elaborate plans for a week end of winter sports, which of course *included tobogganing and skiing Unfortu*nately, in mid week a sudden warm spell melted all the snow In order not to disappoint the students and the guests who were coming to enjoy the events, thousands of dollars were spent to bring in a trainload of snow from the northern part of the state, where it was so deep that highways were blocked and transportation was greatly restricted That was an instance of giving great value to a commodity by bringing it from a place where it was not wanted to a place where it was very greatly desired

Every working day men are busy all over the world, planting, reaping and manufacturing things to be transported by land or sea or air to places where they are needed Engineers make roads, railways, vehicles, ships, barges and planes to assist transport, and the world presents a picture of mountains of goods of all sorts being carried from place to place to satisfy human needs Where once a few barbarians doing little or no trading gained a meager living, great populations exist because of the trade which has been built up

The need for trade, or exchange, is so great that if we were all making things, we should make them in vain People would *simply be piling up goods which* would serve no useful purpose That is why a very large proportion of the population is needed, not to make things, but to carry them or to deal in them or to work in some other way, as in a bank, to help trade

Perhaps you may remember having driven along a country road with your father just before Thanksgiving Day and seeing an especially fine large yellow pumpkin in a farmer's field The farmer may want very badly to sell it, and back in town your mother may

very badly to have just such a pump-
n, and she has the money to pay for it
vever until it has been made into a pie
and is on your table, that pumpkin is of little
alue to anyone In economics this problem
of getting the pumpkin (and other commod
ties) to the consumer or final user, is called
the problem of distribution

Think of the millions of people who must be employed in making and repairing roads docks harbors and railways used in the transportation of goods and in building and repairing or working in warehouses stores shops and offices concerned with the storage and sale of goods A man working on a rail way and help ng to take the farmers pump-kins or cabbage and other products from a sect on where they are plentiful to the city where they are scarce is just as necessary as the farmer If the railroad or truck did not transport these commodit es it would be useless for the farmer to raise them

To go a step further it would be useless either for the railway to carry the farm produce or for the farmer to raise it if whole-sale and reta l stores were not set up where the people of a community could buy the pumpkins cabbage potatoes and other foods when they are wanted So it is with other commodities They have not only to be produced and carried by sea and land and air to where there is a demand for them but they must also be stored and then offered for sale in conveniently located markets and shops From this we can see that the more simple the distribution and exchange of goods is, the better it is for all concerned It is only common sense to see that if a commodity must pass through many hands before reaching the final consumer the price must necessarily be higher

Today in the United States about half of the population over ten years of age is ga n fully employed Of course the proportion is much greater at some times as during World War II for example Under normal conditions however about half of the popu lation is gainfully at work The other half includes the women at home who do not work for wages small children young peo ple in school people unable to work because of illness or old age the relatively small class who do not need to work and a few others Of the many millions who are employed gainfully part are engaged in producing things—that is to say they are either min



Cul er Service

Early trading between Indians and white men was by barter because they had no form of money in common.

ers or quarrymen getting out coal ores and stone or agricultural workers producing food or fishermen or industrial workers producing metals engines machinery tools textiles earthenware rubber goods and oth er articles The rest of the gainfully em ployed workers are engaged either in govern ing or in seeing that the law is obeyed or in transporting of things by road rail river sea or air or in wholesale or retail buying and selling or in banking and insurance or in teaching or in caring for our health or n amusing us in theaters and moving p c ture houses and so on

USEFUL SERVICE IS ALSO PRODUCTION"

Sometimes the word producer is appl ed only to those who grow or make things Ac tually everyone who does useful service is a producer whether or not he actually works in agriculture or manufacturing because all useful work helps production We have just seen that it would be useless for the farmer to raise pumpkins if the railway or truck did not transport them or if the merchant did not deal in them and the man who brings the pumpkin to our door is just as much a producer as the man who guided the plow or the cultivator and finally brought the produce in from the field

It is equally true that if school teachers did not teach if doctors did not attend to our health and dentists did not take care of our teeth if wholesale merchants did not buy and sell in b g quantities and if retail shops were not conveniently located pro duction would be less successful

Somet mes people who trade in goods are called *middle men* and sometimes the term is used in a reproachful way as if it were a reproach to deal in goods rather than to make them This reproach is not deserved if the middle man s business is well organized and if he deals fairly with those he serves The work of merchants agents brokers bankers insurance men and other commer cial workers is indispensable under present cond tions It provides goods at the po nts where they are needed and gives us the use ful distribution of articles after they are made

The banker helps buyers and sellers he takes a real part in product on The lawyer who interprets the law or settles a dispute e ther by private negotiation or by conduct ing a lawsu t is equally indispensable in the present state of society The actor or singer may also claim to help in production be cause he amuses and cheers the life of his fellow men and helps them to work to better advantage

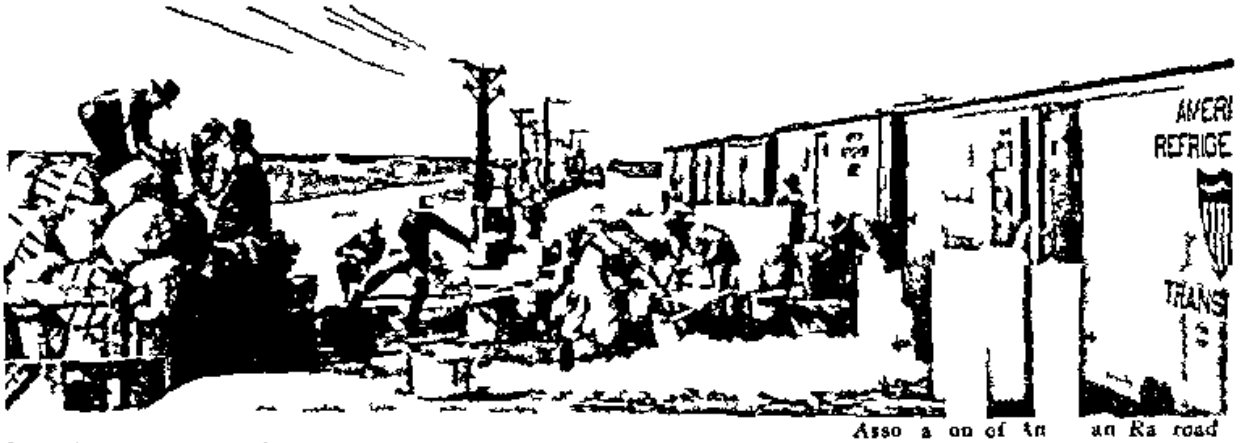
Throughout our history the importance of the middle-man has been steadily growing as a result of the ever increasing division of labor Less than one hundred years ago only about a quarter of those classed as gainfully employed in the United States were middle men Today fully 50 per cent are employed in the process of transferring the newly cre ated goods to the consumers who want them

A considerable part of every dollar that consumers spend goes to the distributor You may for example hear a farmer friend com plain because the bunch of carrots he sold for one cent is sold across the counter of the grocery store for five cents The pair of shoes costing $4 to produce may be sold to your father for $8 and the gallon of gasoline that goes into your automobile tank sells at three times the cost of producing it Actually on the average fifty nine cents out of every dollar we spend goes to the middle man to cover the costs of getting the completed product into our hands These charges some say are entirely disproportional to the serv ices rendered While that would be difficult to prove it is true however, that better or ganization might reduce the number of mid dle men and so help us to obtain a better distribution of commodities

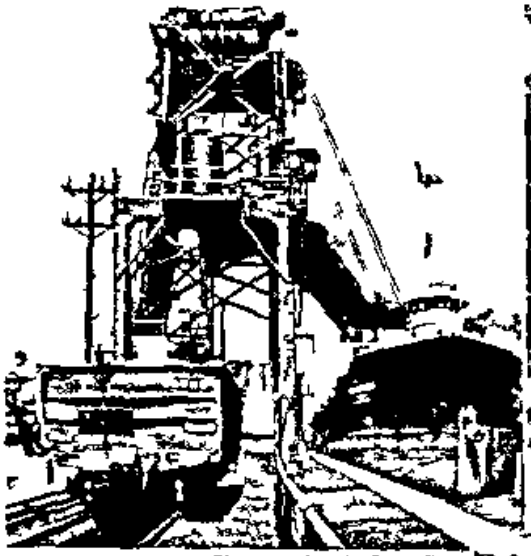
THE TOWN DWELLER S DEPENDENCE ON THE MIDDLE MAN

The following final illustration should drive home to you the fact that the middle man is a very important link in the produc tion process not only in the country as a whole but even in your very own town Do you remember that during the winter of 1944 45 there was a great deal of snow in many parts of the United States and Can ada and also that the war needs were taking more and more men out of peacetime jobs? Your father may have come up from the basement after fixing the furnace for the night saying something like this Well Mother we have just about enough coal to last for two more days I don t know what we re going to do I called the coal dealer again today and he said he can not do a thing for us right now but will get us a quar ter of a ton as soon as he can He said that three of his six coal trucks are in the ga rage because he can not get men to oper ate them Besides there has been so much snow that the railroad can t get coal trains through to our town Perhaps it was de

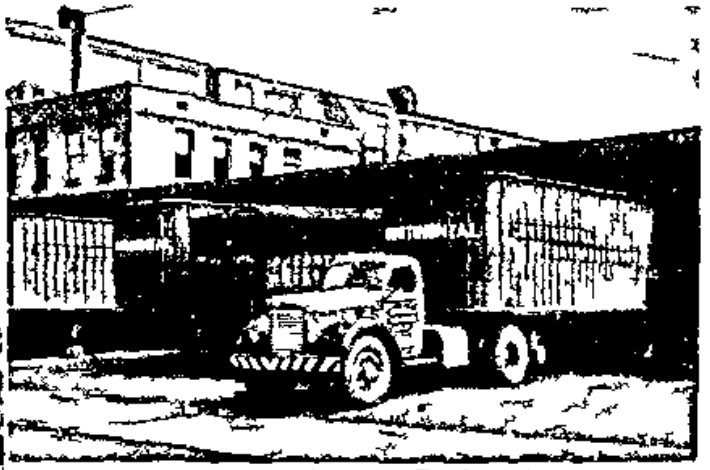
TO MARKET BY LAND WATER AND AIR



Asso a on of An an Ra road
Just pi ked sp nach being loaded in these ref ge ator ca s wi l a rive fresh at market hund eds o mi es away



Ch sapeake & Oh o Ry
Coal on a way f om ra lroad to ship



Am an Tru k ng A on n
Huge motor vans carry goods a oss the b ead h of the land



Pan Amer an Wo d A rways
L ght-we ght and less bulky products are carried swiftly in cargo planes.



Penney van a Ra road
Through th s vast f e ght te minal pass mi lions of a ti les needed by city-dwelle s, whi h they can not p oduce themselves.

cided to close some rooms off to save heat, and you may have slept on the sofa in the living room You can readily realize, if you went through such an experience, that the middle man, the dealer is very, very important to your health and comfort

ONE COUNTRY MAY DISTRIBUTE THE PRODUCTS OF OTHERS

No small part of the wealth of a modern country arises from successful trading in commodities which it does not itself produce Great Britain, for example, had by 1940 become the greatest market in the world for the products of many foreign countries, such as wool tea, cocoa rice spices, tobacco cotton hemp, jute hides, rubber and ivory The trade in such things as these is very profitable to shipowners, merchants and warehousemen, and gives employment to many thousands of workers The benefits of world trade are widely spread

The United States is very large and a very wealthy country Before World War II there were many people who felt that since this was so, it was not necessary to depend upon other countries for the necessities of life Some people even went so far as to say that all foreign goods should be shut out Now let us see how a great nation would really get along if it were to follow this advice and buy only the goods it produces itself

SOME FOODS ON OUR BREAKFAST TABLES COME FROM FAR LANDS

Do you remember what you had for breakfast this morning? Was everything you had produced within the borders of your own country? Perhaps your parents drank coffee while you had cocoa The coffee came from Colombia or Brazil in South America The cocoa may also have come from South America, or possibly from Africa These two commodities may have been packed in cans coated with tin The tin came from Malaya On your cereal you had cream and sugar This sugar may have come from Cuba

You will remember what happened to our source of rubber when Japan struck at the East Indies lands and islands from which rubber comes Rubber tires became very scarce. Then scientists went to work to invent a rubber like substance But tires made of synthetic rubber cost much more than when the natural rubber is used Even in the case of clothing most countries are partly dependent on certain foreign countries Canada sells leather for shoes and wool for clothing to the United States Even some of the newspaper articles urging people in the United States to 'Buy American' were printed on paper made in Canada!

One of the many terrible and costly lessons taught by the war is that no country can live by itself Foreign trade is important Not only is it true that many things we need must come from foreign lands, it is equally true that we produce a great many commodities that the people of foreign countries need Before the war the United States exported about 50 per cent of her cotton, 35 per cent of the tobacco crop, 25 per cent of the office supplies produced and slightly more than 30 per cent of the foodstuffs raised by her farmers This was also true for many manufactured goods, such as automobiles and typewriters By profits from its exports a country is able to pay for the many things it imports from outside its borders

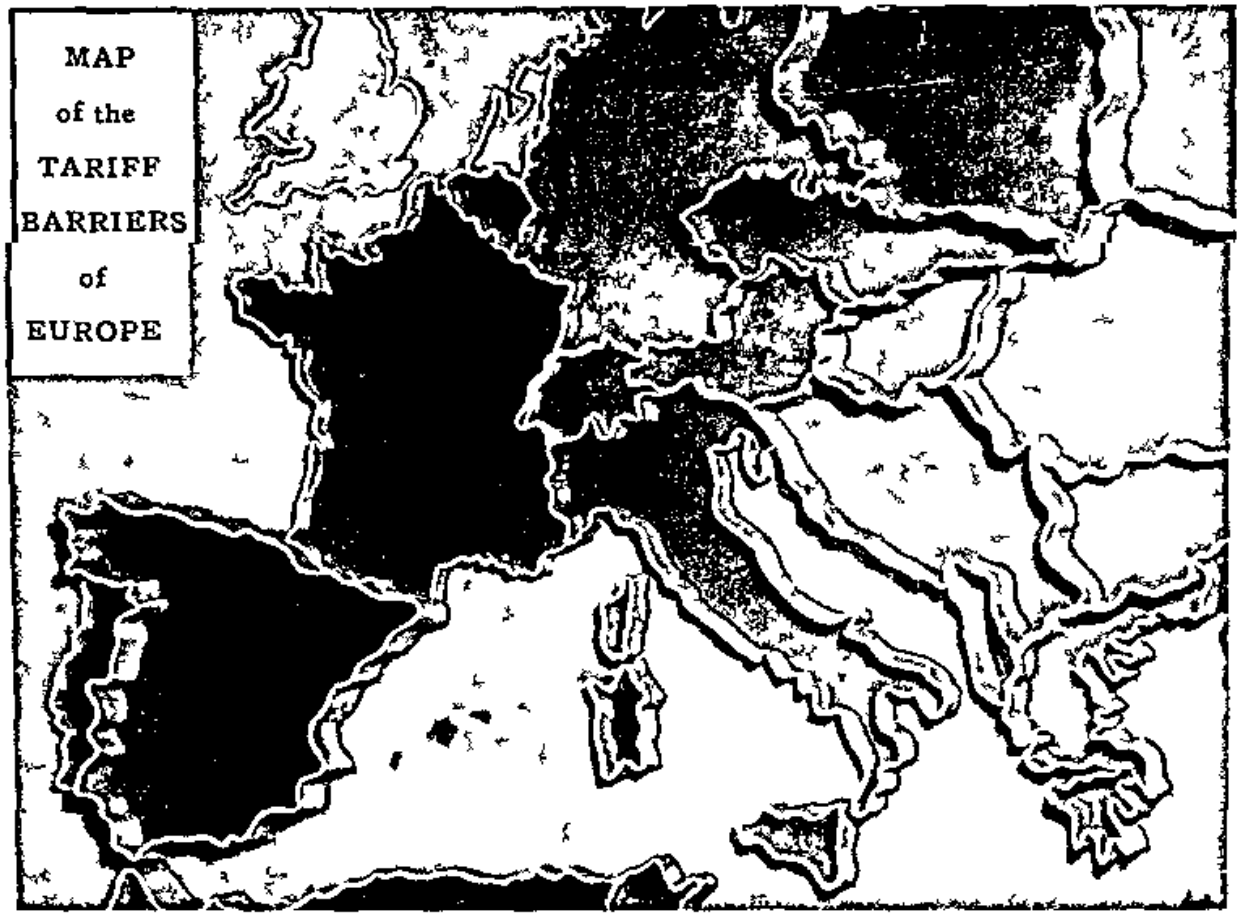
EXPORTS FROM CANADA AND THE UNITED STATES

Every part of the United States and every part of Canada produces something that the people in foreign countries want Likewise the people in every state of the Union and every province of the Dominion use goods that have been produced in foreign lands Under the modern way of life no nation can successfully produce enough supplies to become independent of its neighbors A nation may produce much more of a particular commodity than it can profitably use at home Canada, for instance, has immense forests and can spare wood pulp and paper to the United States and Europe which need them Both Canada and the United States raise more wheat and cattle than they can eat and sell some of these goods to hungry Europe

THE IMPORTS ON WHICH OUR STANDARD OF LIVING DEPENDS

On the other hand, though the United States makes more motor cars than all the rest of the world, it can not grow rubber, and without rubber the motor industry would be very greatly diminished Neither Canada nor the United States can grow coffee, tea, silk, or spices with profit, and neither produces enough sugar for its needs *If* we could not get these products elsewhere thousands of people would be thrown out of employment and millions more would be uncomfortable

The United States produces more oil than it can use, while Canada is the chief producer of nickel, which the United States needs The latter can send oranges, lemons and



From the Overseas Weekly Map

On this map the tariffs of each country are shown as walls the darker the shading the higher the tariff of that country The importance of this map however is that it points up a relation between tariffs and standards of living Where the walls are low as in Great Britain people live well In Spain with a high wall most of the people have just barely enough to exist.

grapefruit to Canada Some of the furs which Canada does not need will more than pay for them All over the civilized world the surplus of one country is sent to another and in exchange necessary articles are received No nation can live and prosper without using the products of others

When the manner of life is simple and the wants of the people are few a group of people can live almost without intercourse with other groups but their state of civilization will not be high One of the marks of an advancing civilization is the great increase in the number and in the kinds of things desired The savage wants only a few things, while the civilized man wants many

If high walls were built around each country, shutting off all communication with other nations the level of comfort and civilization would go down This was shown to be true following World War I, when many of the European countries raised high tariff walls (A tariff wall is a government tax on goods coming into a country from foreign countries) This was one of the reasons, economists tell us why in the early 1930s the worst depression of modern times swept over much of the world

Various countries tried to relieve the depression One proposal was the Reciprocal Trade Plan put forward by the United States This plan had as its aim the increase of trade between all the nations in the civilized world Some twenty nations entered into the plan agreeing to reduce the duties on certain American products and the United States extended the same privilege to certain goods which those countries wanted to ship to us

Neither Germany nor Italy would co-operate in this plan, preferring to be, if they could independent of the rest of the world They soon realized that this policy would not work They needed buyers for their goods Italy then invaded Ethiopia in order to obtain a colony that could be forced to buy Italian goods Shortly thereafter Germany adopted the same procedure under Hitler Nazi troops boldly invaded one after another of the neighboring coun



Canad an Nat onal Ra lways

Canada rich in nickel ships the ore to other countries and gets from them products it lacks.

tries of Europe Hitler s plan was to have Germany become the great prosperous man ufacturing center of Europe with the other nations reduced to a state of agricultural servitude Thus Germany would be self suf ficing at the expense of the rest of the world We all know the terrific loss of life and the great suffering that resulted from the pur suit of such a wrong policy

It is to be hoped that no nation will ever again follow the silly notion that it can stand alone cut off from its neighbors A large country like Canada or the United States or the Soviet Union could survive longest after adopting such a way of life but there would be much discomfort Surplus goods would pile up Factories would close and millions of people would be thrown out of work

Where a country depends chiefly upon manufacturing and trade conditions would be much worse Great Britain is a small country with a large population for its size It produces hardly a third of the food it eats but buys food with coal from its mines or with manufactured articles Probably if an end should be put to foreign trade a greater quantity of food could be raised than at present but not enough to support half the people who now live there They would be forced to emigrate or starve

In the summer of 1944 forty four nations sent representatives to a World Economic Conference held at Bretton Woods New Hampshire By that time much progress had been made in the war against Germany and Japan and leaders in many nations did not want to see the same mistakes made with the coming of peace that followed World War I You know from your history that after 1918 some unfortunate things happened Many of the great nations seemed to think as we have just seen that the only way to have peace would be to stay away from each other and do everything possible to promote political and economic self sufficiency We call this policy isolationism The opposite policy is co operation

Believing that the only possible way to save world prosperity is by co-operation in trade and commerce the delegates to this conference drew up a plan It is known as the Bretton Woods Plan for World Economic Cooperation

Before the definite plan was drawn up many ideas were proposed One was that the monetary standards in each country (such as the dollar and the pound sterling) be abol ished and an international standard with an entirely new name be adopted The idea was too extreme to be accepted

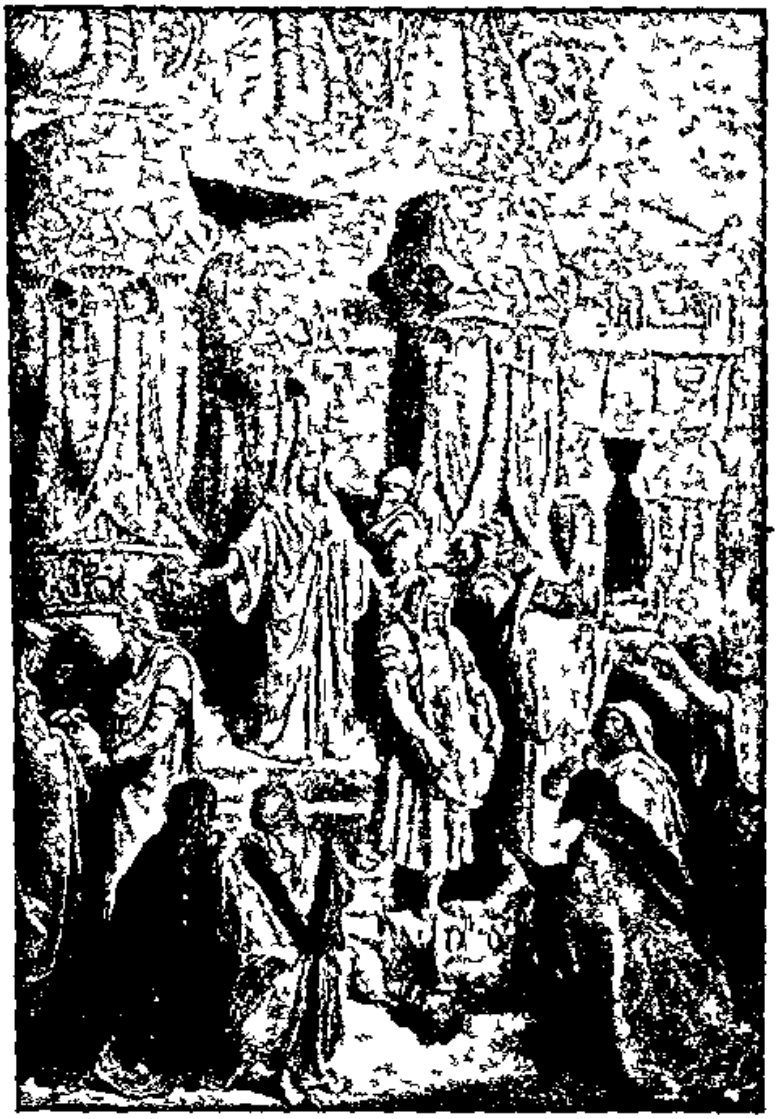
As finally adopted the plan called for two devices The first was an International Bank through which all financial arrangements connected with international trade must go This of course would greatly simplify the problems of trade and commerce among na tions scattered all over the earth

A PLAN FOR HELPING ALL NATIONS TO BECOME PROSPEROUS

The other device proposed was an Inter national Stabilization Fund This fund would be created through contributions of money by the nations The money would go into a common pool When necessary money from the pool would be loaned on good security to help nations temporarily in need Money would also be loaned to backward nations in the belief that if they could be made pros perous, the world as a whole would benefit

Before it can become effective it must be passed upon and approved by the govern ments of the forty four nations A start has been made Time must test the Bretton Woods plan if it is adopted It is at least a great step in co-operation in international trade and finance

Remember this—the greater the division of labor the more dependent men become upon each other Remember also that every passing year sees an increase in the division of labor



The Orient of Song and Story

By Burges Johnson

Author of "As Much As I Dare"

Goodly vessels of gold and of silver Cyrus restoring the sacred treasures stolen from Jerusalem by Nebuchadnezzar as told in Ezra Chapter I

IN the olden days of romance, war itself was considered romantic Men rode gallantly away on horseback in their suits of armor, wearing a lady s glove or bit of ribbon at the saddle bow Battles were really a great number of single combats, and often two armies would pause in their fighting to watch while two champions rode at each other, and the outcome of that single contest determined the winning and losing sides But science has taken the romance out of war, and war itself has destroyed more romance than the world can ever replace

The grimness of war has struck with full force in the romantic East, where a sultan once journeyed on some fantastic adventure with his trusted vizier beside him, may now be a cluster of oil wells, and a pipe line runs through an oasis where once Scheherazade rested in her palanquin surrounded by her retinue of slaves as she journeyed to meet her husband Bombs may have destroyed some inn where Kublai Khan paused to celebrate a victory The banks of the stream in India where Kim s Holy Man ended his long quest may now be the site of a factory which uses the water power to turn the wheels of looms that Hindu maidens once operated

Our two world wars have almost destroyed the mystery of the Orient. Persia has become Iran, and the British and Russians fight their diplomatic battles in its old palaces to see which shall make the most out of its modernized industry Egypt still possesses her pyramids, but the Sphinx views with astonishment a school of journalism in Cairo turning out young reporters

We speak of the East, but where is it? In one sense it is any part of the world which is east of where you are standing at the moment We who live in the eastern part of

SOME TREASURES OF THE ORIENT



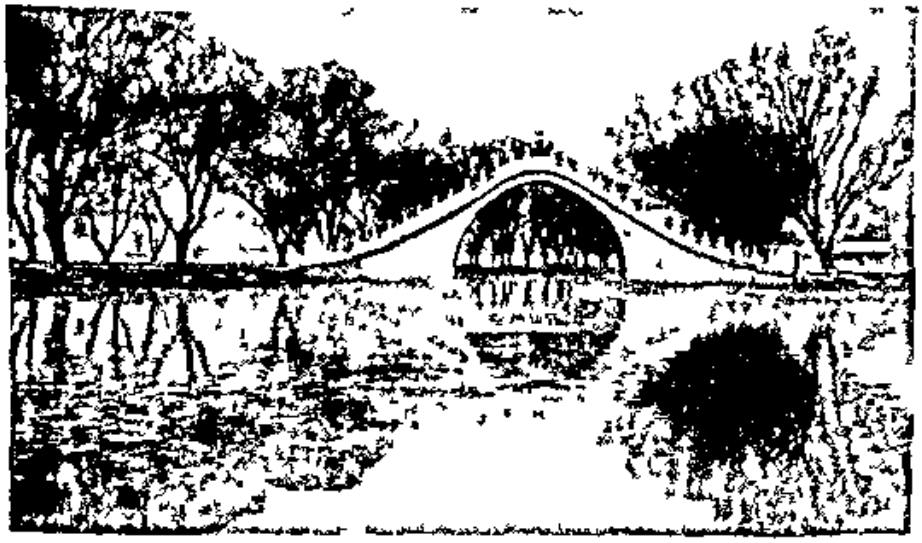
Musician A figurine from China



Flowers grace this porcelain vase Chinese

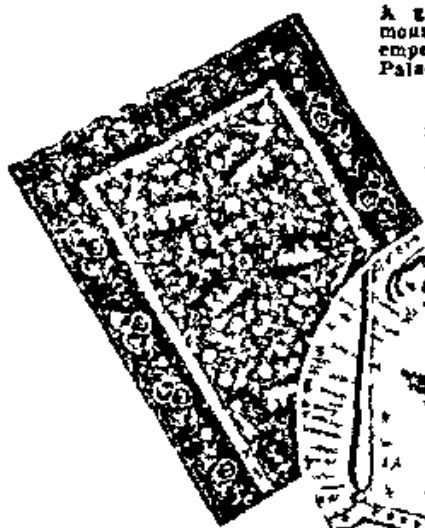


Brahma seated on a lotus. South India



A gem of perfection—this famous bridge once delighted the emperors of China Summer Palace Peiping (Peking)

Art objects on th s page, Metropol tan Museum of Art



A Persian animal rug in beautiful colors and intricate design.



Robe exquisitely embroidered China



Culver Service

The Mogul emperor Akbar splendidly bejeweled.

Canada or the United States know what is meant by the West, if we spell it with a capital letter We do not mean any place which happens to be west of us, but we mean that part of the country which was once a frontier, peopled by cowboys and Indians and cattle rustlers and 'bad men," whose speech was full of such terms as 'Stick 'em up!," 'Ride 'em cowboy," and "Another redskin bit the dust'

In the same way the East, spelled with a capital letter, has come to mean those countries just beyond the edge of that world which European civilization knew when it was younger China is west of San Francisco, but in the days when all modern civilization was centered in Europe, China was thought of as "Far Cathay" It lay to the eastward and few men had dared travel so far Those who did, like Marco Polo, brought back strange tales. India, too, lay to the eastward, and so even did Turkey and the Hellespont and the farthest isles of the Mediterranean

GREAT DARING WAS NEEDED TO REACH THE FAR EAST

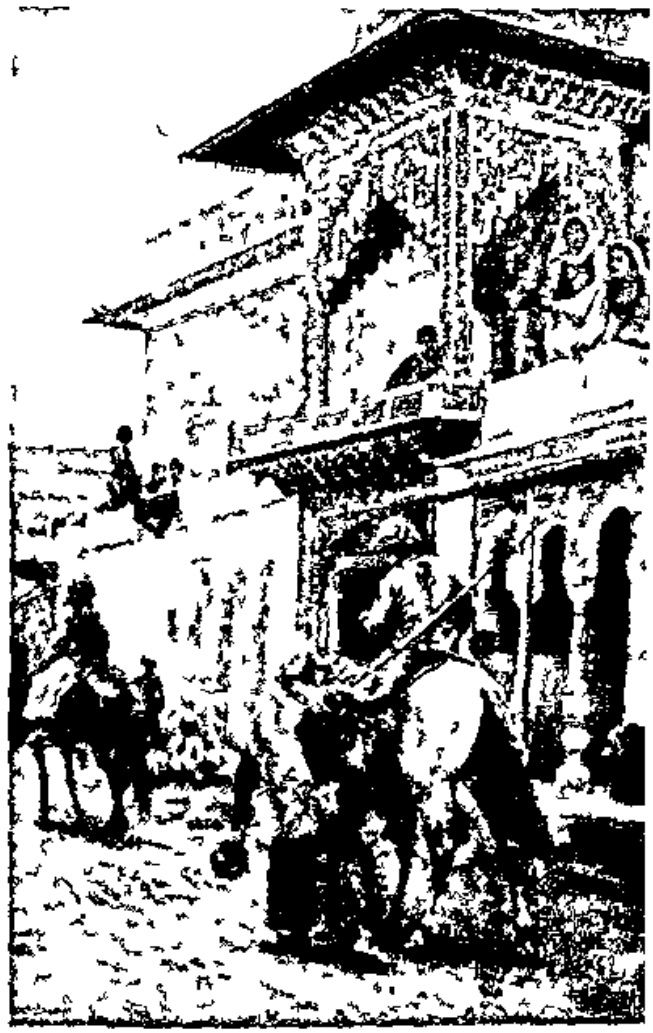
The daring traveler, journeying eastward, just before he reached the mosques and the minarets and the guarded harems of Turkey, came to Greece and the Balkan lands, and these he called the Near East, and of course came to know them sooner Turkey and Palestine and the borders of Egypt and Arabia were the Middle East, and beyond them lay India, and the mysterious hermit country of Tibet, and the fabulous cities of China and the spicy isles of the Indian Ocean These made up the Far East, or the Orient, the lands out of which the sun rises, for that is what the word means

More travelers in the early days told about the Orient than had ever seen it Perhaps they got as far as Cyprus or the isles of Greece and asked about what lay beyond and they were told fantastic yarns, because villagers have always enjoyed telling tall stories to visitors about what lies just beyond So the travelers went home again and told what they had heard and added a little to it, and imagined a number of things that they said they themselves had seen So they were admired by all their neighbors as great travelers who had seen wonders and faced dangers, and each time they repeated the tales of their travels, they remembered a little more

Out of such fanciful stories grew the legend of the Orient, and even today, when ships and planes and the Oriental Express take us from the old European centers into the Near East and the Middle East and the Far East, we find it hard to separate fact from fiction in those old records and hard to guess just how far it was that ancient travelers got on their journeys

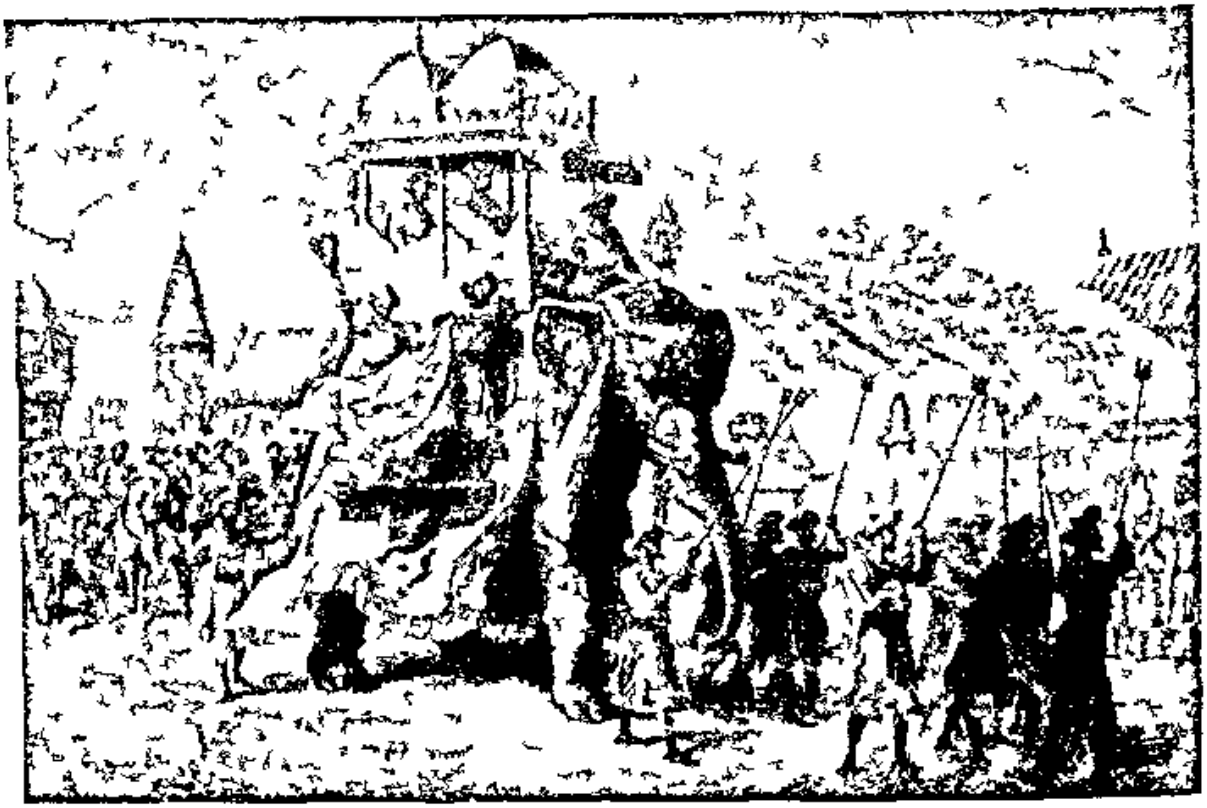
Even today, when we in our new land reach the 'Far East by traveling west from our west coast we find legends far back in the hills of China of white men who came as visitors centuries ago We are even able to trace the strange journey of Marco Polo and find the records that the Chinese have preserved of his visit

Now two great wars have spread like forest fires around the world swirling destructively through one Oriental country after another, carrying soldiers in British and American uniforms into lands which were once known to them only in fairy tales



Courtesy New York Public Library

Travelers in Delhi, India, passing the time of day with beautiful maidens on their high balcony This romantic scene was painted by E. L. Weeks.



Atop a mighty elephant, this Indian monarch is very grand. He is leading a procession of cavalry

and stories of strange perilous adventure

Yet the Orient still keeps some of the mystery and romance that it possessed in earlier times India is presenting now an outward appearance of modern civilization She has her great factories and foundries her smelters and her power plants Schools and universities are scattered among her principalities Many of her maharajahs are graduates of Oxford and have traveled in the United States Yet the story of Kim the white lad who journeyed through the country as begging boy for a Holy Man and without knowing it served in the British Secret Service could be repeated today In the deep valleys of India and among her mighty hills people live as they lived centuries ago and their ways would seem as mysterious and as romantic to us as ever

Persia was drawn into the war because American supplies had to be carried across it from the Mediterranean to Russia which lay beyond But the chief reason it was stirred up by the passions and greed of mankind is its great treasure of oil So modern rails had to be laid and modern oil wells had to be drilled and trained laborers had to come out of the West, with engineers and contractors to direct them New cities peopled by British and French and Russians and Poles sprang up about these industries Yet still in the hidden recesses of Persia one may find palaces and villages and princes and peasants who might have stepped out of story books

Arabia is a vast desert and it does not invite the tourist to settle down where the sun beats so fiercely and the blown sand cuts the skin yet the Arabs love their native land with a passionate loyalty So the Arab still lives his nomadic life and drives his camels or rides his wonderful Arabian steeds and seems little changed by the centuries as they pass He reads from the Koran

> God's is the east and the west and wherever ye turn there is God's face verily God comprehends and knows

And somewhere at the same time a Persian poet is telling a tale in song and the Holy Man of India with his begging bowl is speaking of the freedom of man's soul

Somewhere in Eastern lands magicians still perform tricks that even our wisest men are unable to explain and somewhere a Chinese scholar is murmuring lines from Li Po the poet

> I hear the Tsang tsung road
> Is rough and rugged and hard to travel.
> It is so steep that the mountains rise
> In front of the rider's face

And the clouds gather about the horse's head
But there you will find the plank highway of Chin
Canopied in fragrant foliage
And the sweet water of springtime
Flowing around the city wall of Shuh

Among the spicy isles native chiefs are practicing strange rites and despite the war the Orient is still the Orient with its peoples and their ways only half understood by men of the West Its alluring colors and its voices and its strange landscapes enchant us if we are so fortunate as to travel in that direction perhaps chugging in some coasting vessel with its lascar crew from Mandalay to Rangoon where the dawn comes up like thunder outer China crost the Bay

The men and women of the Orient dress in gayer colors than we and they dance and sing more readily and in some countries weep more loudly and publicly Theirs is a simpler land and a simpler life than ours so they seem to cling to the ways of childhood longer

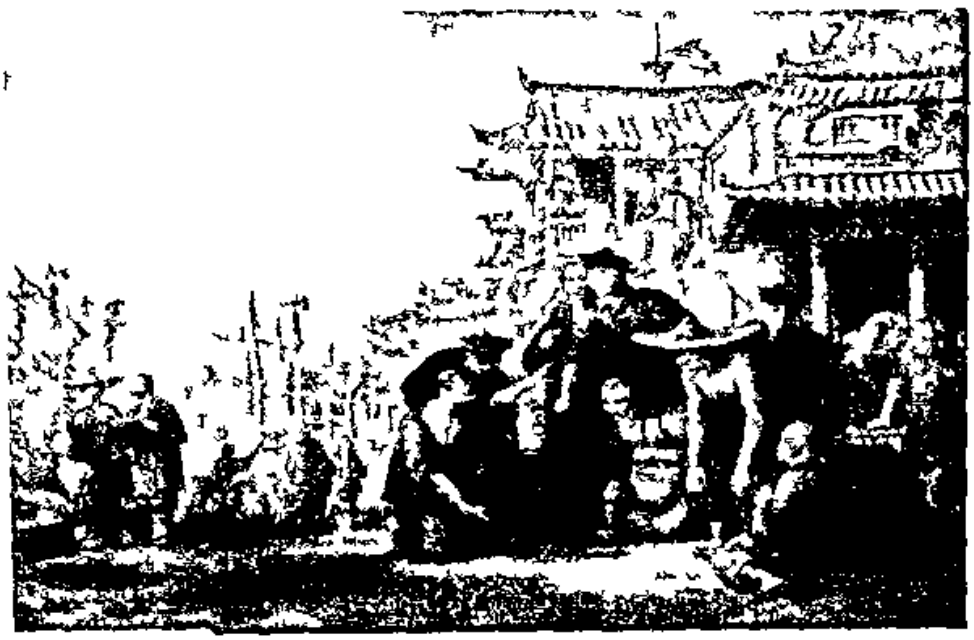
The men and women of the Orient do not hurry as fast as we do They do more day dreaming and more story telling Grown folk tell fairy tales to one another about powerful jinn imprisoned in bottles and beautiful ladies who like the Sleeping Beauty suffer under some magician's spell until a handsome prince or even a poor porter comes to free them and marry them and live happily forever after Perhaps this story telling is because there are fewer books in the Orient so the tales are passed along from the old people to the grandchildren

Dreams are mysterious things you know If they seem to you fragile and easily lost you are far afield from the truth For dreams survive in the midst of sorrow Suffering can not kill them As in centuries long gone by they still bring their gentle comfort to the homeless of the earth

Tales of romance and mystery—dreams—are one of the great gifts of the Orient not only to the East but to millions in the West as well Today the world holds high hopes of building a better lot and a better life for Oriental peoples As we watch change sweeps on thundering feet across the Eastern lands But the dreams of the East lie very deep and they may change but little It may be that the great heritage of the East will forever bring fresh courage to the heart of man and stir his soul with beauty



Arab steeds like their riders are famous



The water front in old Canton China. The center group watches a quail fight. At the left a man is selling a large fish.

Prizes and Awards



Day a statue of Prometheus by Paul Manship

EVERY year many prizes and awards are given for outstanding work Here we list a few of the ones given in 1945

Academy of Motion Picture Arts and Sciences For work done in 1944 Best picture—GOING MY WAY Best actor—Bing Crosby Best actress—Ingrid Bergman Best supporting actor—Barry Fitzgerald Best supporting actress—Ethel Barrymore Best direction—Leo McCarey for directing GOING MY WAY

American Academy of Arts and Letters and the National Institute of Arts and Letters Howells Medal to Booth Tarkington author and playwright $1 000 poetry prize to Wystan Hugh Auden poet Medal for good diction on the stage to Eva Le Gallienne Gold medal of the Institute to Paul Manship sculptor

American Association of University Women $2 500 Achievement Award to Dr Katharine Burr Blodgett researcher in molecular films and inventor of non reflecting or invisible glass

American Section of the Society of Chemical Industry The Perkin Medal highest honor in applied chemistry to Dr Elmer K Bolton for leadership in the development of neoprene, the first general purpose synthetic rubber

American Institute of Electrical Engineers Edison Medal the highest award in electrical engineering to Dr E F W Alexanderson for inventions and developments in the radio transportation marine and power fields

American Library Association Caldecott Medal to Elizabeth Orton Jones illustrator of Rachel Field's PRAYER FOR A CHILD Newbery Medal to Robert Lawson author of RABBIT HILL

American Society of Mechanical Engineers Medal To Dr William F Durand for jet propulsion and other scientific work Holley Medal to Dr Sanford A Moss for his pioneer work in turbosuperchargers

Book of the Month Club Selections

STORY OF THE SECRET STATE by Jan Karski

ANYTHING CAN HAPPEN by George and Helen Papashvily

THURBER CARNIVAL by James G Thurber

APARTMENT IN ATHENS by Glenway Wescott

BLACK BOY by Richard Wright

THE BALLAD AND THE SOURCE by Rosamond Lehmann

THE AMERICAN GUERILLA IN THE PHILIPPINES by Ira Wolfert

COMMODORE HORNBLOWER by C S Forester

UP FRONT by Bill Mauldin

THE WORLD THE FLESH AND FATHER SMITH by Bruce Marshall

RICKSHAW BOY by Lau Shaw

THE WHITE TOWER by James Ramsey Ullman

CASS TIMBERLANE by Sinclair Lewis

DAYS AND NIGHTS by Konstantine Simonov

BEACH RED by Peter Bowman

LOVELY IS THE LEE by Robert Gibbins

Churchman Award To Henry A Wallace, for the 'promotion of good will and better understanding among all peoples"

Ford, Julia Ellsworth, Foundation for Children's Literature To Nancy Barnes for her story WONDERFUL YEAR

Guggenheim Fellowships The John Simon Guggenheim Memorial Foundation gave 96 fellowships valued at $2,500 each

Junior Literary Guild Selections

Primary Group—

GREGORIO AND THE WHITE LLAMA by Laura Bannon

THIS IS THE WORLD by Josephine Pease

WINGS FOR PER by Ingri and Edgar Parin d'Aulaire

LING TANG AND THE LUCKY CRICKET by Kay Stafford and Louise Zibold

THE LITTLE FELLOW by Marguerite Henry

ILENKA by Lee Kingman

THE GROCERY MOUSE by Eleanor Clymer

THE EXCITING ADVENTURES OF WALDO by Earl and Linette Burton

NICK AND NAN IN YUCATAN by Alan Crane

NECESSARY NELLIE by Charlotte Baker

RAGS' DAY AND MRS SILK by Helen Hoke

THE ANTIQUE CAT by Bianca Bradbury

Intermediate Group—

TWO YOUNG CORSICANS by Anna B Stewart

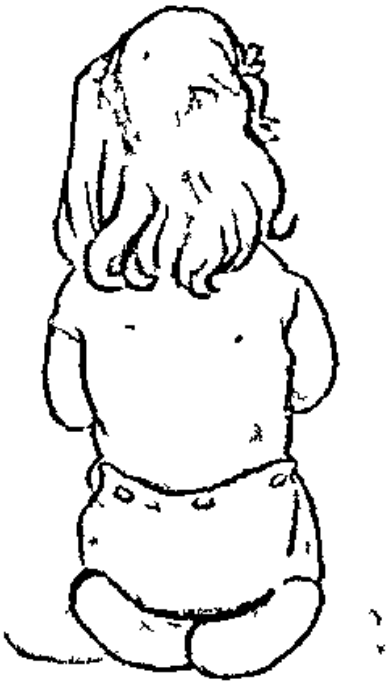
RABBIT GO-LUCKY by Phyllis N Cote

RUNNING AWAY WITH NEBBY by Phillis Garrard

THE ROOSTER CLUB by Valenti Angelo

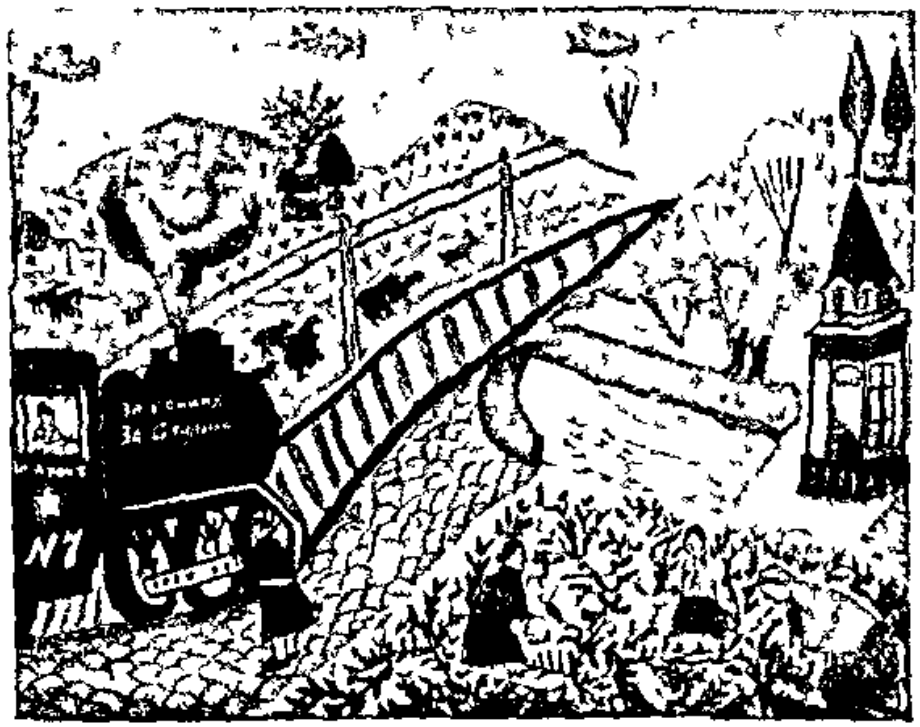
MYSTERY OF THE OLD BARN by Mary Urmston

SKY HIGHWAYS GEOGRAPHY FROM THE AIR by Trevor Lloyd



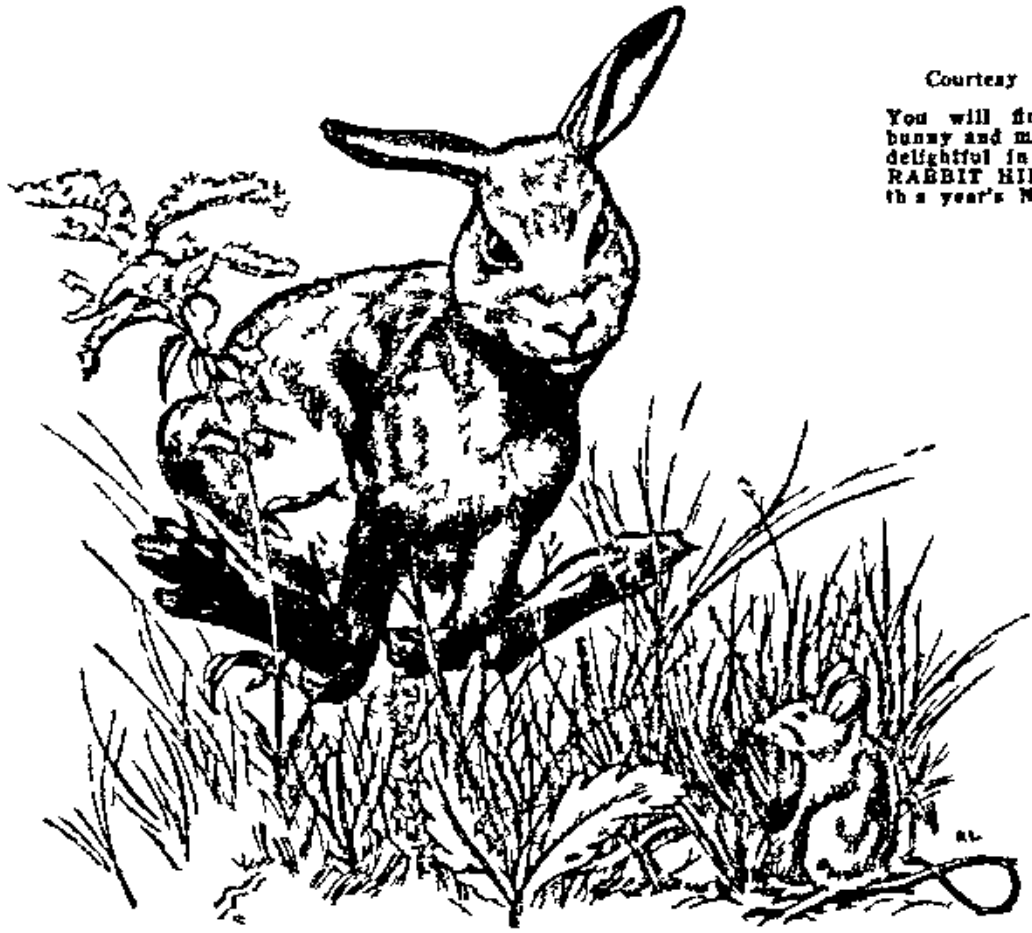
Courtesy The Macmillan Company

This little girl is one of the pleasant pictures Elizabeth Orton Jones made for PRAYER FOR A CHILD by Rachel Field



Courtesy Oxford University Press

Russian children made the colorful drawings in the picture book LITTLE PEOPLE IN A BIG COUNTRY winner in the New York HERALD TRIBUNE prize contest.



Courtesy The Viking Press

You will find this bounding bunny and many others just as delightful in Robert Lawson's RABBIT HILL, the winner of this year's Newbery Medal.

THE VERY GOOD NEIGHBORS by Irmengarde Eberle

THE GULF STREAM by Ruth Brindze

THE ESKIMO HUNTER by Florence Hayes

CHILDREN OF SOUTH AFRICA by Louise A Stinetorf

FISH HOOK ISLAND MYSTERY by Wendell Farmer

THE MITCHELLS by Hilda van Stockum

Older Girls Group—

THE SECRET SPRING by Emma A Jacobs.

ON THE EDGE OF THE FJORD by Alta Holverson Seymour

PIONEER ART IN AMERICA by Carolyn Sherwin Bailey

MYSTERY SCHOONER by Terence Roberts

THE SINGING CAVE by Margaret Leighton

BRAVE NURSE by Ellsworth Newcomb

JONICA'S ISLAND by Gladys Malvern

NEW FOUND WORLD by Katherine B Shippen

BRAMBLE BUSH by Marguerite S Dickson

SENTINEL OF THE SNOW PEAKS by Harold McCracken

THE YEAR WITHOUT A SUMMER by Ethel Parton

MYSTERY IN BLUE by G E Mallette

Older Boys Group—

THE AVIATION DICTIONARY FOR BOYS AND GIRLS edited by Leslie E Neville

NORTHERN TRAIL ADVENTURE by West Lathrop

STANLEY'S AFRICA by Rafaello Busoni

BEYOND THE CALL OF DUTY by F M Reck

HURRICANE TREASURE by Bert Sackett.

EXTRA! U S WAR CORRESPONDENTS IN ACTION by John McNamara

STOCKY BOY OF WEST TEXAS by Elizabeth W Baker

YOUR FORESTS by Martha Bensley Bruere

THE BLACK STALLION RETURNS by Walter Farley

THE AMERICAN BOY'S OMNIBUS by Stanley Pashko

HULL-DOWN FOR ACTION by Armstrong Sperry

MIKE MARONEY, RAIDER by David Lavender

National Association for the Advancement of Colored People The Spingarn medal for the highest and noblest achievement by an American Negro was awarded to Paul Robeson singer and actor

New York Herald Tribune Prizes for

children s books Best picture book, Norma Cohn s LITTLE PEOPLE IN A BIG COUNTRY, illustrated by Russian children Best book for children under 12 Ruth Brindze s GULF STREAM, illustrated by Helene Carter Best book for older children, Elizabeth Janet Gray s SANDY

Nobel Prizes Some of the 1944 awards were made in 1945

1944 Chemistry—Prof Otto Hahn, of Berlin now in the United States

1944 Peace—International Committee of the Red Cross Geneva Switzerland

1945 Chemistry—Prof Artturi Virtanen of Helsinki Finland

1945 Literature—Gabriela Mistral, of Chile

1945 Peace—Cordell Hull, Washington, D C

1945 Physics—Prof Wolfgang Pauli of Zurich Switzerland and Princeton, New Jersey

1945 Physiology and Medicine—Sir Alexander Fleming London Dr Ernst Boris Chain Oxford England Sir Howard Walter Florey, Oxford, England

Pulitzer Prizes

Novel—A BELL FOR ADANO by John Hersey

History—UNFINISHED BUSINESS by Stephen Bonsal

Poetry—V LETTER AND OTHER POEMS by Karl Shapiro.

Biography—GEORGE BANCROFT BRAHMIN REBEL by Russell Blaine Nye

Musical composition—APPALACHIAN SPRING a ballet by Aaron Copland

Drama—HARVEY by Mary Coyle Chase

Scholastic Awards SCHOLASTIC MAGAZINE sponsors a contest open to all junior and senior high school students in the United States and Canada Among the winners are

Art—Oils Richard Preyer Arnold Abramson Water color Morris Silverman Helen Singer Crayon Margaret Stucki Arnold Abramson Ink Gilbert Tucker Gilbert Zabarkus Vasso Ameredes Earl Agrima Pencil Priscilla Hutchins John Clague Prints Leona McNeley, Raymond Johnson Sculpture Aldo Pitassi, Frank Suleri Ceramics Mildred Stockowski Lillian Bajerski

Literature—Essay Joyce Anne Lewis Poetry W Jerome Marquis Short story J H Stearns

Musical Composition—Piano solo Dick Banks Ensemble composition Perry Thew

Photography—Dick Lindgren Thomas Donlon George S Schreyer Zuleime Wooten



Courtesy Paramount Pictures, Inc

The gentleman in the baseball suit is Bing Crosby surrounded by some of the young singers who helped to make GOING MY WAY very popular The Academy of Motion Picture Arts and Sciences voted it the year's best movie

Questions before the World Today

By **Norman Corwin,** *author of On a Note of Triumph*

YOU listen to the radio don't you? Maybe to Bob Hope and Henry Aldrich and sometimes to swing music and every now and then with one ear you hear the news broadcast when your parents have that kind of program on the radio Perhaps at school you have a chance to listen to broadcasts like School of the Air The people responsible for these programs try very hard to make them interesting to you but I suspect that because they are connected in your minds with school you may not be trying as hard as you *could* to be interested in them That would be too bad because there are problems confronting the world today which are harder to solve than any which have arisen in recorded history The serious programs on the air—news coverage and such broadcasts as the School of the Air which I mentioned—attempt to put these problems before you for one good reason *You are the people who will have to solve them!*

You who are now in grammar school and junior high school will very soon inherit a world which at the time of this writing had been at peace for only four months An uneasy peace unfortunately as you know if you have followed the headlines in the newspapers or learned about it in school Civil war in China Bloodshed in Palestine Disturbances in Iran The British and Indonesians battling in Java Misery and dictatorship in Spain

Many men and women hoped victory in World War II would bring a new union and brotherhood to people all over the world But mankind has not yet learned how important it is to love thy neighbor as thyself You know about the bitter disputes going on in the United States between labor and management—between workers and their employers You have heard the ugly and menacing words race riot! You may even have seen a boy beaten by other boys for no better reason than because his skin was a different color or his religion slightly different from theirs

I'm going to present a few of the main problems right now I'm going to ask questions hoping that you will answer them, and keep on answering them today and tomorrow and the day after

(1) Can the union and strength which the Allies demonstrated in World War II be made to carry over into the peace and assure that for all time to come men of all nations will stand together to preserve the freedoms?

(2) Will workers all over the world be granted decent working conditions and a wage which will allow them to live in security and comfort to educate their children to provide for themselves beyond their own productive years? In other words will we work as hard to assure economic freedom—freedom from *want*—as we have worked to guarantee political freedom freedom from fear freedom of speech and religion?

(3) Will atomic energy, with its awesome and terrible possibilities for destruction and its equally powerful possibilities for the creation of new benefits to humanity be used for good or evil?

(4) Will a man who is intelligent and trustworthy and kind and industrious be granted opportunity for success and happiness only if he belongs to a racial or religious

group which is in the majority? Or will the *members of minority groups—for instance,* in some countries, the Negro and the Jew—be judged as all men should be judged, on their merits as individuals?

On your shoulders, when you have graduated from high school or college, will fall the responsibility of solving these great prob lems Your older brothers and your fathers and your uncles, who have fought a war to assure a better world for you, will be getting older then They will have made some prog ress, but they will be tired and sometimes dispirited about the task of bringing order to the universe As a man gets older his thinking sometimes slows down, even as his body slows down, and he is no longer capable of doing the work he did when he was young Your fathers and your teachers are less flexible in their thoughts and actions than you can be, for their opinions have been colored by years of association with one kind of job and perhaps a limited group of friends and acquaintances

But you should come to this great task free of prejudice, with enormous capacity and appetite for all kinds of opinions and facts It is up to you to sift them to find the truth, and to work for what you believe You will have strength and hope and vision Always the intinitely slow process of making the world a better place to live in year by year falls to those who can best carry the burden—the young It is a burden, but a fascinating one But I don t have to tell you that You re already interested in it, or you wouldn t be reading an article in a volume called THE BOOK OF KNOWLEDGE ANNUAL

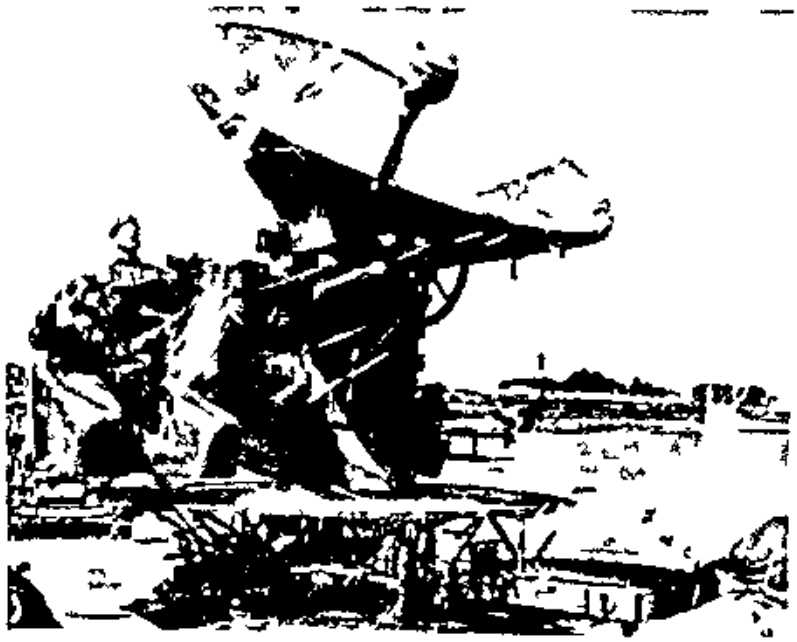


Aigner, from Monkmeyer

To understand world problems, keep your geography up-to-date These fifth graders use plastic maps.

Radar

HOW WE MAY SEE WHAT OUR EYES CAN NOT SEE



Wide World photograph

American soldiers operate a captured nazi anti aircraft radar set at Foggia Italy Shown in the picture are the strips of tin foil called "window" which were scattered by the Allies to confuse the radar operators with false echoes

NOT too long ago in the early days of World War II the word radar was something that was not even whispered The wartime secrets it stood for were known only to the highest military and scientific authorities Radar meant magic and the magic was secret Today with the cloak of secrecy torn from many of its applications we are allowed to see understand and use radar for peaceful accomplishments

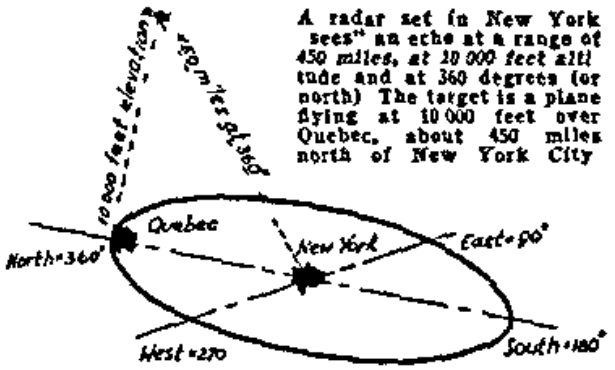
Radar was born by accident and mothered by necessity In 1922 one of the first observations of radio echoes was made by Dr Albert Taylor of the United States Naval Research Laboratory Dr Taylor noticed that a ship moving in the path of transmitted radio waves reflected echoes back to the radio receiver In the years that followed the uses to which this basic principle was put were of necessity largely secret due to their military importance But thousands of scientists and billions of dollars worked in its development

Radar is a child of radio This is seen in the make up of the word radar It was put together from the first letters of the following words *RAd o Detection And Ranging* From this it is easy to see much of the job that radar does It detects or searches out, objects that are invisible and it reports on the objects range or location The latter may itself include three parts range elevation and azimuth meaning how far away, how far above or below and in what direction from the radar set For example a radar spotting station in New York may get an echo from an object at a range of 450 miles at about 10 000 feet elevation and at an azimuth reading of approximately 360 degrees That would locate the object probably a plane at an altitude of 10 000 feet in the vicinity of Quebec north of New York See the sketch on page 233

The principle of radar is very similar to that of sound echoes or wave reflection If you shout in the direction of a cliff or other sound reflecting medium you will hear the shout return to you after a short period of time The time between your original shout and the moment the echo hits your ear is the time necessary for the sound to travel to the cliff and return We know that sound moves at about 1 100 feet a second so you can see that by measuring the time interval accurately it is possible to determine the distance to the cliff If a person is 2 200 feet from the cliff when he shouts the sound will return to him in four seconds two seconds are used in going toward the cliff and two seconds to come back By refining the operation a bit it is easy to determine the direction of the cliff from the person and its height as well This is true since the sound will be reflected to the greatest extent when it is directed exactly at the cliff and not at some point to the right or left or above it

Radar is essentially the same in its theory of operation Instead of sound it uses high frequency radio waves which travel as you know at about 186 000 miles per second

This means, of course, that the echo-time intervals one has to measure are very small However, they can be measured accurately to better than one ten millionth of a second The reflected echoes are sent through an intricate electronic system and at the end appear in picture form on the fluorescent screen of an oscilloscope This is usually called a scope The echoes appear as disturbances on this screen which are called blips, or pips



A radar set in New York sees" an echo at a range of 450 miles, at 10 000 feet altitude and at 360 degrees (or north) The target is a plane flying at 10 000 feet over Quebec, about 450 miles north of New York City

There are scales on the screen to make direction and distance determination easy for the observer

There are many applications of radar Huge ground stations are capable of detecting planes long before they come into range of sight or hearing Intricate systems direct fighter planes in the black of night or the gray of fog Complicated networks of long range navigation (LORAN) stations span approximately one quarter of the earth s surface, helping navigators to plot their courses Radar sets on both land and shipboard control equipment such as searchlights, anti aircraft guns and big gun batteries Portable equipment carried in airplanes helps direct gunfire helps search for enemies in the sky, on the land and sea, permits identification of friendly aircraft and assists pilots to land safely in bad weather Radar bombing equipment permits planes to blast targets at night or through thick clouds

The dramatic victories of radar in World War II are countless In the Battle of Britain, during the autumn of 1940, a comparatively small band of brave flyers in the Royal Air Force were able to turn back the German bombers night after night, with the help of radar In one twenty four hour period 232 enemy planes were shot down

D Day in Normandy saw radar play a big part in bombing key targets Paratroopers and gliders were guided to their destinations by small radar sets flown in with the first attackers A twin brother of radar, known as RCM, or Radar Counter Measures, was responsible for destroying much of the effectiveness of the German radar warning systems RCM operates by filling the air with false echoes to deceive "listening' radar detectors

The list is really endless We could talk about the Battle of the Bulge, where ground radar sets directed attacking Allied planes in pea soup weather We could mention how the British tracked down and sank the nazi battleship Bismarck, how the submarine threat was reduced by radar bombing, how German and Japanese cities were destroyed like ducks in a shooting gallery, how Guadalcanal was held because of a great naval triumph, due largely to radar aid But these are the victories of war, and our thoughts are now on peace

In the next few years radar will be installed on nearly all the ships of the world s merchant marine This electronic miracle will see' from the bridge through fog and inky blackness It will warn of icebergs, other vessels, reefs, sunken hulks or shorelines It will point out channel markers, lighthouses, buoys and docks

Aviation is now coming of age in round the world transportation, and radar promises to be a pillar of strength in its progress Flying s biggest enemy, the weather, will lose much of its threat Installed in planes and on the ground, radar will point out bad weather, jutting mountain peaks and other airplanes when the human eye is helpless It will permit almost totally 'blind' landings at fog bound airports

To what deeds of wonder scientists will lead radar no one can foretell, but the advances that have been made give promise of many new developments to come



Official United States Navy photograph

Men work with an air of tension in the radar plot room of an aircraft carrier Here the information provided by the radar is coordinated, written down and studied.

Radioactivity

THE STORY OF SELF SMASHING ATOMS

By Willem J Luyten

University of Minnesota

LOOK at the table of elements on page 45 Draw an imaginary line above lead atomic number 82 The part of the table below the line we may consider to be a corner of Nature s laboratory where many fascinating things are going on including atom smashing on a grand scale

The elements that take part in this atom smashing are polonium (84) radon (86) radium (88) actinium (89) thorium (90) protoactinium (91) uranium (92) All of these have very heavy atoms 210 to 238 units All are metals except the gas radon All send out strange rays which we can not see with our eyes though some of them are powerful enough to go through paper aluminum iron and lead We call this sending out of rays radioactivity and the study of radioactivity is a brilliant chapter in the story of science Men and women living in many countries have a place in the story each one picking up the clues discovered by earlier scientists and in turn handing on new clues to the younger students following them

In 1895 Professor Wilhelm Konrad Rontgen of Germany discovered X rays—mysterious invisible rays which could pass through some substances but not through others and make still others suddenly shine brightly

They were called at first Rontgen rays after the man who found them but we know them better as X rays X in many languages stands for something mysterious or unknown Rontgen s discovery had taken the scientific world by the ears Scientists everywhere were curious about the strange rays and groped for an explanation They made all kinds of experiments in the hope of finding the solution to the riddle Some thought that X rays came from the glass of the X ray tube because the glass begins to shine at the point where the X rays fall on it. Phosphorescence we call this effect in science Students tried to see if other materials that phosphoresce in the dark after being in ordinary light also give off X rays



National Film Board photo

Children are shown uranium deposits at the Eldorado mine, Great Bear Lake, Canada.

One of the men who tried along these lines was Professor Henri Becquerel, of Paris He did not have much luck until he tried a salt of the rare metal uranium This he knew did phosphoresce brilliantly after being in ultra violet light First he let the light shine on some of this greenish looking salt then he wrapped it tightly in black paper and put it on top of a photographic plate, with a thin sheet of silver in between After leaving it this way for several hours he developed the plate and found black spots on it The plate had been "exposed" In other words, the ura nium salt must have sent out rays of some kind that had passed not only through the black paper, but also through the silver Later he tried other uranium salts and even the metal itself, and found that all uranium materials sent out these same rays, even those materials that did not phosphoresce after being in light As these new rays are given off in the dark, Becquerel knew that they were not X rays He also found out very soon that they did something to the air through which they passed, in much the same way that X rays do When the new rays were passed through the air near an electrified body, it would slowly lose its charge This must mean that the air, which is normally a good insulator, was almost changed to a conductor by these rays, it let electricity pass through, or, as the scientists say, it became "ionized"

Ernest Rutherford, in England, made further studies on these rays and soon found that there were two kinds among the ura nium rays He called them alpha rays and beta rays, after the first two letters of the Greek alphabet The alpha rays are stopped easily, that is, they will not pass through sheets of paper, but they do ionize the air very strongly The beta rays can pass through sheets of iron and some other met als Rutherford figured that it must have been the beta rays that blackened Becque rel's photographic plate, for there they had to pass through both silver and paper

Later, it was found that radioactive bod ies send out still another kind of rays still more penetrating than the beta rays These were simply called gamma rays, after the third letter in the Greek alphabet

RADIUM AND POLONIUM ARE DISCOVERED IN PITCHBLENDE BY MARIE AND PIERRE CURIE

Two earnest students worked with Bec querel in Paris They were Pierre Curie, a French physicist, and his Polish wife, Marie Sklodowska Curie These two examined a large number of ores and compounds of ura nium and found one piece of rock to be very much more active than other uranium compounds This came from the uranium mines at Joachimsthal in Bohemia, and was known as pitchblende because it looks so black They suspected that this ore might contain other elements even more radioac tive than uranium So they wanted to study the pitchblende very carefully They were pretty sure that what they were looking for was in the ore in very very small amounts so they knew they would need hundreds of pounds of rock to investigate it They were lucky enough to get, from the government of Austria, a whole ton of the waste ma terial left over after the uranium had been taken out of the ore After a long heart breakingly difficult job of examining the ore, and purifying it, and then purifying it again and again, they were finally able to set free from the mass two new radioactive elements

The first of these Marie Curie named po lonium in honor of her native country, Po land The second one was called radium Both of these substances are much more ac tive than uranium Radium when it is very pure is several million times stronger than uranium in sending out rays

PROTONS ELECTRONS AND NEUTRONS ARE THE MOST IMPORTANT PARTICLES IN THE ATOM

After the discovery of radium, progress was very fast, so many scientists began to work on radioactivity that discoveries fol lowed each other in very quick succession The knowledge gained in fifty years has been amazing

Before we can proceed with the story, let us briefly review our understanding of atoms

No one has ever seen an atom but scien tists guess that the largest of them may be only one hundred millionth of an inch in size Yet every atom is made up of still smaller particles The most important particles are protons, electrons and neutrons The proton weighs so little that if you counted the num ber of protons that make up half an ounce, you would need to write down a number with twenty five zeros after it

10,000 000 000 000,000,000,000,000!

The proton carries a small charge of posi tive electricity, the smallest amount that exists

The second of these particles, the electron, carries the same amount of electricity, but of the opposite kind so we say that the pro ton has a positive charge and the electron a negative one A proton and an electron at-

tract each other very strongly but two protons try to get away from each other—they *repel* one another, and electrons repel one another What is strange among these very small particles is that while they have the same amount of charge, the electron weighs only about 1/1850 as much as the proton

A NEUTRON SEEMS TO BE A PROTON AND AN ELECTRON LOCKED CLOSELY TOGETHER

The third particle, the neutron, weighs virtually the same as the proton, but it has no electric charge that is why of course, we call it a neutron A neutron seems to be a proton and an electron locked close together, canceling one another s electric charge Scientists guess that a proton may be around a trillionth of an inch in size Though there is no way of seeing such particles, we have been able to devise several ways of making visible their effect on gases And we have many photographs that show the path of a single proton or electron These, of course, are particles that do not belong to any atoms, we call them free protons and free electrons

The article on Atoms, page 43, tells how protons, electrons and neutrons combine to make the different elements, from hydrogen, which has one proton and one electron, to uranium, which has 92 protons, 146 neutrons and 92 electrons Always an atom has an equal number of protons and electrons that is—an equal number of positive and negative electric charges, which add up to no charge

The protons and neutrons are packed tightly together in a lump in the center of the atom We call the lump the nucleus The electrons circle round the nucleus at high speed The electrons seem to be arranged in layers or shells, and the shells follow certain patterns The uranium atom has 2 electrons in the shell nearest to the nucleus, 8 in the next shell, 18 in the next, then 32, 18, 12 and 2

An atom with 238 protons and electrons is heavy, too heavy The forces that hold nuclei together are not strong enough, and so the uranium atoms sooner or later begin to fall apart As a nucleus falls apart it sends out the rays we have been speaking of—the alpha, beta and gamma rays That is what radioactive means

The alpha rays are chunks from the atom, two protons and two neutrons locked together It is more exact to call them alpha particles They carry a double electric charge

The beta rays are also particles. They are electrons Yes, they are electrons that come shooting out of the nucleus, though there are no electrons in a nucleus What happens is that a neutron violently splits into an electron that dashes out and a proton that stays behind

The gamma rays are not particles, but real rays

In the past chemists had always found that whenever chemical elements "reacted with each other they could speed up this reaction by heating and slow it down by cooling or if they were dealing with gases, by compressing the gas or thinning it out But the remarkable thing about these radioactive substances is that nothing we can do changes the way in which they send out their alpha, beta and gamma rays We know now why this is so, of course In chemistry we are really dealing with the outside layers, or shells of the atoms—but radioactivity comes from the nucleus, where we can not get at it, for the nucleus is too well protected by all these outer layers We shall come back to this later on in the chapter

As we learn more about radioactivity we have to use many new words and terms to describe what happens. One of these is "emanation" which we use to describe the gas that is produced by some radioactive elements Usually this gas is itself radioactive With the radioactive element actinium, for example, we can make this experiment we wrap some substance that has actinium in it in a thin sheet of paper and take it to a dark room We then lay it on a screen on which we have smeared a little phosphorescent material such as zinc sulphide After a while, this screen will begin to glow all around where the actinium lies But if we blow at it, the glow goes away for a few minutes and then comes back This proves that it is not the actinium itself, but a gas arising from the actinium which makes the screen glow

WIRE WHICH COMES INTO CONTACT WITH AN EMANATION BECOMES RADIOACTIVE ITSELF

Often, too, we find that almost any object that gets close to such an emanation behaves as if it were radioactive itself What happens is that when the emanation gas touches a metal wire, for example, it leaves a very, very thin film as a coating on the wire, and this thin film stays radioactive for a while As the film is so extremely thin we can not see it, and so the wire seems to have become radioactive

While the only rays known to be sent out

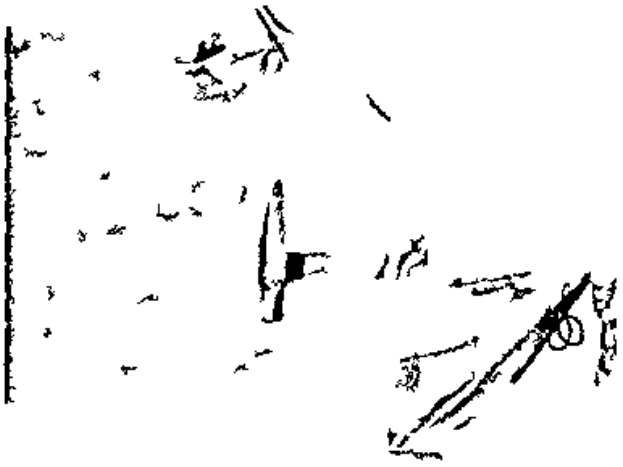
by radioactive materials are alpha beta and gamma rays there is still a good deal of difference in the way they do it We might say that there are only three kinds of radioactive guns, each shooting only one type of bullet, but some shoot much faster than others and there is a difference in the amount of explosive used by each

We can measure the speeds of the alpha and beta particles They are electrically charged so when we make them pass between two powerful magnets or between two plates charged with high voltage they no longer move straight but begin to turn and travel in a curve By this means we have found out that the alpha rays travel at speeds of 10 000 miles per second or more Among these very tiny particles this is not really a very high speed and they usually do not get very far A thin sheet of paper or even an inch or so of air will stop them The faster they go the farther they can travel before they get stopped—the slowest alpha particles get stopped after one inch of air but the fastest with speeds of about 15 000 miles per second, can travel nearly 4½ inches The beta rays are very much lighter and they travel much faster than alpha particles Some of them have speeds up to 180 000 miles per second that is almost the speed of light They can also go much farther They are much more penetrating as we call it they can go through sheets of paper easily, and even through a sheet of aluminum a tenth of an inch thick

Since the gamma rays are not particles but behave like invisible rays of light we can not make them curve around between magnets But they are very much more penetrating than the alpha and beta particles They can get clear through a piece of iron eight inches thick, or even through one inch of lead

ELECTRON VOLT AND HALF LIFE ARE AMONG THE NEW TERMS WE ARE BEGINNING TO USE

All of these rays represent energy being spent—like a bullet traveling through air When they are stopped this energy is turned into heat and we can measure this heat We find it easier, though, not to express the amount of heat they would produce, but, especially with the beta particles to say that they behave in exactly the same way as an electron which moves between two electrically charged plates that have a very great difference in voltage, such as three million volts And so the physicist says that such a beta particle has an energy of three million



National Film Board photograph

A prospector carefully examines some radioactive ore which has been detected by using the portable Geiger machine that he is carrying strapped to his side

electron volts meaning that it has a quantity of energy equal to that gained by one electron when it travels from one electrically charged plate to another which is charged three million volts higher He writes that 3 Mev and this is another of the new terms we have begun to use in radioactivity

Still another term is half life To explain what that means we have to look at radioactive atoms in the same way as an insurance company looks at people When a person who is 30 years old takes out life insurance he pays a certain amount of money each year to the company and the company, in return promises to pay say $10 000 to his children when he dies Now if he should die the day after he takes out his insurance the company will lose a great deal of money but if he lives until he is over 90 years old the company will make a lot of money No one ever knows what is going to happen to any one person, but from their records and tables the insurance companies know that once people have reached the age of 30 say they will on the average, live until they are about 70 So the companies calculate their premiums in this way then they are sure that on the average the company will make a little money The same is true for radioactive atoms if we had just one atom we could not tell what would happen to it. But even in a pinpoint there are more than a million times a billion atoms and physicists now say (from their experiments) that among a particular kind of atoms it will take, say, one day before one per cent of them has sent out an alpha particle Now this would not mean that after one hundred days there would be nothing left It does not work that way Let us take another case

Let us start out with 1,000 atoms and suppose that 100 of them, or 10 per cent break up the first week That leaves 900 and 10 per cent of 900 is 90, so the second week 90 atoms break up, leaving 810 Ten per cent of that is 81, so at the end of the third week there will be 729 left, and 73 would break up the fourth week, 66 the fifth week and 59 the sixth week, leaving 531 at the end of the sixth week So, while 10 per cent would break up the first week, it takes six weeks and four days before 50 per cent has broken up and that length of time we call the 'half life' of that kind of atom

HALF LIFE MAY VARY IN DIFFERENT ATOMS FROM YEARS TO FRACTIONS OF A SECOND

For different radioactive elements the half life varies enormously, from 22 billion years for ordinary thorium to a one hundred billionth of a second for another kind of very radioactive thorium To give you an idea of how active even so slow an element as ordinary thorium is Suppose we had just one ounce of pure thorium, and we could make visible by a flash every alpha particle sent out by it We should see 60 000 flashes every second and after 22 billion years still only half of that one ounce would have been broken up

We said that each atom always has the same number of electrons moving on the outside as it has protons inside the nucleus What happens when the nucleus shoots out an alpha particle—that is, a combination of 2 protons and 2 neutrons? Doesn t that change the electrical balance of the atom? Yes, and the atom must balance itself after the explosion What happens when the uranium nucleus, for example shoots off an alpha particle, is that the atom that weighed 238 before now weighs only 234 It has two protons that is, two positive charges less in the nucleus, so it must also lose two negative charges, that is, it must lose two electrons It does this by getting rid of two electrons from its outer shell This will change its chemical properties and make it behave somewhat similarly to thorium So we see that when a radioactive element shoots off an alpha particle it loses in atomic weight and changes its chemical properties as well, in other words it becomes a NEW chemical element This is the dream of the Middle Ages. It was known as alchemy, the changing of one chemical element into another The technical name for it is 'transmutation of elements What they really wanted to do in the Middle Ages was to make gold out of cheaper metals We still can not make gold out of cheaper metals That is, we might possibly change a few atoms of one element into gold, but to make a pound of gold from cheaper elements by transmutation would take us thousands if not millions of years

What happens to the electrical balance of the atom when it shoots out a beta particle? In this case a neutron in the nucleus splits into an electron—the beta particle that darts away—and a proton that stays behind Now the atom has one more positive charge than it had before so in its outer shell it has to pick up one more electron That is not difficult There are always plenty of slow electrons loafing around in space that is, they are not traveling faster than a few thousand miles per second After an electron has been captured the atom has again changed its chemical behavior, though this time not its atomic weight

Usually the story does not end there, for when an atom is radioactive and shoots off an alpha particle or a beta particle it does not stop but keeps on sending out more alpha and beta particles, and changes progressively into a number of other elements Finally it settles down to what we call a stable element Such a whole chain of radioactive changes we call a series, and at present we know three of them One begins with uranium, one with actinium and one with thorium The first one is the most famous because radium belongs to it, so let us look at it a little more carefully

ONE OF THE RADIOACTIVE SERIES STARTS WITH ORDINARY URANIUM METAL

It begins with ordinary uranium, an atom of total weight 238, containing 92 protons, 146 neutrons and 92 electrons First it shoots off an alpha particle, rather slowly, for the half life of uranium is several billion years It then becomes uranium-X_1 of atomic weight 234, but chemically nearly the same as thorium This breaks up again by shooting off a beta particle, living a half life of three weeks, and changing into uranium X_2 Now uranium X_2 does the same thing again, but much faster, living a half life of only a little more than one minute and changing into uranium II But now, after first having lost one alpha particle with two positive charges, and two beta particles with one negative charge each, the atom has not changed electrically at all However, it has changed in weight down to 234, and what we have is a new form of uranium, known as an 'isotope of that metal An isotope is almost the same

as the original element except that it has a different atomic weight and a different density This again breaks down very slowly with a half life of 300 000 years, giving off alpha particles and becoming ionium, of weight 230, and chemically again similar to uranium X1 and thorium With a half life of 83,000 years, ionium sends out another alpha particle and changes into radium, the most famous radioactive element of all It has a weight of 226 Chemically it is similar to magnesium Radium continues the activity and sends out an alpha particle Any given amount of radium is half used up in 1 600 years It changes into radon, or radium emanation, a very heavy gas of atomic weight 222, and chemically similar to neon But radon is very active, its half life is only four days, after which, by sending out another alpha particle, it changes into radium A which again shoots off an alpha particle and is half gone in three minutes becoming radium B By this time we have lost six alpha particles and the atomic weight is down to 214 The chemical behavior is somewhat the same as that of lead It is an isotope of lead But even this atom is still radioactive very much so, by shooting off beta particles and after a half life of a little under half an hour it changes into radium C, which repeats, and with a half life of twenty minutes becomes radium C' This is the champion performer of them all, for after a brief life of only one millionth of a second it sends out alpha particles and changes into radium D, now with an atomic weight 210, and again an isotope of lead

Here we slow down a little, for radium D has a half life of 22 years It gets rid of another beta particle, becoming radium E which does the same trick, only faster, with a half life of only five days It becomes polonium For the last time we get rid of one more alpha particle, and after a half life of 140 days we wind up with an atom that weighs only 206 (we have lost 8 alpha particles, or 16 protons and 16 neutrons out of our original uranium atom) The new atom has the chemical properties of lead Now it has come to stay, for this isotope of lead no longer changes, it is really stable

THE SERIES BEGINNING WITH ACTINIUM AND THORIUM ALSO END UP WITH LEAD

Just how physicists have gone about proving every one of these steps we can not explain It has been a long and difficult task The other two series one beginning with actinium, the other with thorium, also end up with lead, and again they stop there—radioactively speaking, this lead is dead But—and this is the interesting and important part—while all these end products are isotopes of lead and behave exactly the same way chemically they do not have the same weight Uranium radium lead weighs 206 actinium lead weighs 207, and thorium lead weighs 208 Now if we take an ore such as thorianite, which comes from the island of Ceylon and which contains a great deal of uranium we always find a small amount of lead in it—some of it must be thorium lead and some uranium lead and if we examine it very carefully we can tell these two kinds of lead apart Next, if we know the half life of all the intermediate products we can calculate how long it would have taken for the uranium in this ore to have produced the uranium lead, and how long for the thorium to have made the thorium lead, and if these two answers agree, then we have a pretty good idea how long ago that particular piece of ore was formed

A VERY GOOD ESTIMATE ON THE AGE OF THE EARTH IS ABOUT TWO BILLION YEARS

We do not yet know exactly how the earth was born but we do know that in the beginning the earth was so hot that its materials existed in the form of gases then gradually they cooled off and became liquid, much like lava and still later this lava froze into rocks So long as the earth was still a gas or a liquid everything could move around and mix but once it became a solid piece of rock the particles could not get away from each other any more—the uranium lead had to stay with the uranium from which it was made The answer that we were getting above then tells us how old the rocks are in the crust of the earth The best answer we have up to now is about 1,850,000,000 years We can make a very good guess that the time the earth was a gas or a liquid was very much shorter than this, and we may therefore say that the earth was born about two billion years ago

Since radium is the best known of all radioactive elements let us talk a little more about it—where it is found, what it looks like and so on Radium is always extracted from uranium ores and the first radium ever obtained by the Curies in Paris, came from uranium ore mined at Joachimsthal in Bohemia This is a very rich ore called pitch blende, but there is not a great deal of it In the United States there are some ores in southwestern Colorado, and Utah, called car

notite which is rather poor in uranium and radium The richest of them all lie in the Belgian Congo These African ores are called soddite after Frederick Soddy an English scientist who worked with Rutherford Large deposits of uranium radium ore have been found near Great Bear Lake in Canada The Eldorado mine there lies only twenty six miles from the Arctic Circle How long and difficult a job it is to get the radium pure you can guess from the fact that 100 tons of uranium generally contain only one ounce of radium At first one gram of radium cost $100 000 (nearly $3 000 000 per ounce) but after the discovery of the ores in the Congo and in Canada the price dropped to $20 000 per gram Just before the war the whole world produced about four ounces of it per year most of it going to the United States where medical use alone was more than one ounce per year

Pure radium is a shiny white metal that melts at 1 300 degrees F but tarnishes quickly in the air Chemically it is similar to magnesium and to calcium If we could count the alpha particles sent out by an ounce of pure radium we should see a million times a million flashes every second And so you can see how it would be possible by using very sensitive electrical instruments to prove the presence of one ten millionth of a millionth of an ounce of radium This is very lucky indeed for sometimes one of those tiny glass tubes with a radium preparation in it worth thousands of dollars gets lost in a hospital Then a physicist is called in and he often spots it in an ash can, or a wastebasket where it has been dumped with sweepings from the floor, or even in the sewer After radium sends out its alpha particle it changes into radon, or radium emanation the heaviest known gas It boils at a very low temperature, and as a liquid it is nearly as heavy as iron Radon is extremely active in sending out its rays and particles —100,000 times as active as radium itself— even at hundreds of degrees below zero it shines with a bright pink glow

A tiny speck of radium sends all its alpha rays into the air but in a larger amount even as little as a pinhead the particles sent out by the interior get stopped by the outer layers And so the radium heats up and the physicists have found that a small piece of radium would heat up its own weight of water to the boiling point in about forty five minutes. From this we have calculated that a large part of the heat inside the earth comes from radium and because the earth is not getting any hotter we can also estimate that there can not be more than 300 million tons of radium altogether in the earth This sounds like a good deal but it is really only one part in 20 000,000 000,000 in the whole earth

We have said that radium is used in medicine The way this came about is very interesting In 1901 Becquerel while working with radium accidentally burned himself then Pierre Curie deliberately tried to do the same to himself and in this way began what we call radium therapy What happens



National Film Board photograph

One of the world's great sources of radium is located at Port Radium, in Canada It is owned by the Dominion Government.

is that the rays sent out by radioactive substances can 'burn' and even kill and destroy the cells and the tissues in plants and animals. So, just as with X rays, doctors tried to find out whether radioactive materials could be used to cure cancer and certain skin diseases. But very early it was found that radioactive substances are extremely dangerous and must be handled with the utmost care. At first, if a radium preparation were given it would often cure a cancer by killing the diseased tissue, but after that it went on radiating and burned healthy tissue and sometimes even killed the patient. Then it was found that radon—the radium emanation which is a gas—is thousands of times as effective as radium itself. A method has been developed whereby some of this gas is sealed in a very thin glass tube, and this 'needle' is inserted into the sick part of the body. Four hours after the preparation is first made it reaches its greatest activity and after four days—its half life—it begins to die down.

LUMINOUS PAINTS WHICH USE RADIUM MAKE YOUR WATCH DIAL SHINE IN THE DARK

Another field where radium and other similar elements found a practical use is in luminous paints. To make these a very tiny amount of radium is mixed with zinc sulphide—*1 part in 10 000 or so*. Zinc sulphide has a strange property. When it is hit by the rays sent out by radium which we can not see it begins to glow with a sort of a greenish light. For the first three weeks after the paint has been mixed this glow gets brighter and brighter, then it drops off to about one-fifth of what it was at first, and stays that way for many years. You have undoubtedly seen watches and alarm clocks in which the numbers on the dial and the hands had been painted with some greenish looking stuff. That is—it looks greenish in daylight. But take the watch into a dark closet, or look at it by night. You will see the figures on the dial glow. A great advantage of this light is that while you can easily read the time on your watch and clock, when you are near, the glow is really so feeble that a few yards away it is entirely invisible. This made it useful during the war. Instruments on ships and sights on field guns and rifles were treated with luminous paints. It was used, too, in painting signs on air raid shelters and spots that had to be made visible during a blackout.

Luminous paints find a great deal of use on the instrument panel of airplanes. We may see it a good deal on the dashboard of our cars and you have probably seen it used on the little tips of the pull-chain for an electric light fixture, on doorknobs and other things which we have to find in the dark. In the next few years we may see a tremendous increase in the use of these paints, especially if the price of radium comes down still further, and if we can make sure that by using it so much we do not run the risk of getting radium burns.

UNLIKE OTHER PROCESSES RADIOACTIVITY CAN NOT BE SPEEDED UP BY USING HEAT

Scientists have made a great many experiments with all kinds of atoms and have made atoms do all kinds of things. But these things could always be influenced by heat or cold by electricity or magnetism. Take coal and oxygen—leave them together at room temperature and nothing happens. But heat the coal to the right temperature and it begins to burn, that is to say, it unites with oxygen to form carbon dioxide. But if we heat the carbon dioxide still more, it begins to fall apart again. Not so with radioactivity. The rate at which radium is shooting off alpha particles can not be changed by any means we know and in this way radioactivity is unique. We now understand why the chemical behavior of atoms depends upon the outermost layer of electrons and naturally, by heating or cooling, or putting electrical forces on it, we can get at that outer layer fairly easily. But radioactivity happens to, and in the nucleus which is way inside the atom, and is well protected by this barrier of several layers of electrons. It is the same with a house. If there is a strong wind howling outside, it will rattle shutters and shake windowpanes, tear some shingles off the roof, or perhaps even blow the chimney down, but in a well built house you will not be bothered by the storm when you lie snugly tucked into bed. So the problem was if we want to do something to radioactivity we have to get through to the nucleus itself. How can we do this? Rutherford saw the solution. A radioactive atom shoots off alpha particles, so why not try to shoot alpha particles at the nucleus? Now that is easier said than done, for not only is the nucleus very, very tiny, but no one can see it, so we can not take aim. It is as if a man were to go out on a pitch black night, into a forest, hunting for a pheasant. If he blindfolded himself, and then fired one shot from a rifle, he would not have much chance of hitting the pheasant. But if he fired a machine gun,



Acme

Heat given off by an atomic bomb explosion turned sand into green particles which looked like glass

turning it in all directions and for several hours, he might score a hit That is just what Rutherford did he built a machine that produced a constant stream of alpha particles and then bombarded his atom with those And in this way he found that a nitrogen nucleus, weighing 14, actually could catch an alpha particle with weight 4 and then would temporarily become an atom of fluorine—not an ordinary one of weight 19 but an isotope, of weight 18 Then something else happened, for this kind of fluorine apparently is not stable—it broke up into heavy oxygen (17) and hydrogen (1) And so for the first time, man had put a helium and a nitrogen atom together and made oxygen and hydrogen out of them He had changed one chemical element into another He had succeeded in transmuting one element into another This was in 1919, and immediately a great many scientists began bombarding all kinds of atoms in this way, to see what happened Let us look at some more of those experiments in detail, because they led to a very important discovery

When the very light metal beryllium—like magnesium, but still lighter—was bombarded with alpha particles the same thing happened Beryllium with a weight of 9 took up an alpha particle of weight 4, but immediately the new atom, with a weight of 13, split, becoming ordinary carbon of weight 12, and shooting off a particle of weight 1 But—now it was found that this particle had no charge at all, and Chadwick in England, who discovered this, called it the NEUTRON, and for this discovery he was given the Nobel Prize in physics Now that we know about the neutron we understand much better how an atom is put together and the whole story we told you before would have been unknown if it had not been for the discovery of the neutron

At first it was difficult for physicists to get the alpha particle going fast enough for these bombardments They built several machines, guns, from which to shoot these particles One of the most successful of them is the cyclotron invented by Ernest Lawrence in California in 1931 About the same time that the neutron was discovered Anderson, at the California Institute of Technology, found another new particle, one that weighs as little as an electron, but has a positive charge He called it a positron

A few years later brought still another great discovery Frederic Joliot and his wife, Irene Curie the daughter of the famous Pierre and Marie Curie, found in 1934 that when they bombarded ordinary aluminum with alpha particles, a stream of new rays, or particles, was sent out which they found to be positrons, but—and this was the great, new thing—after they shut off the stream of bombarding alpha particles the aluminum kept on sending out its positrons for some considerable time In other words, they had made a new radioactive substance Since then, experiments have been made with all kinds of atoms and we know now that nearly every chemical element can be made radioactive artificially In most cases they break up rather quickly their half life being only a few minutes or hours but sometimes they last for days and even years

RADIOACTIVE SUBSTANCES ARE USED BY THE MEDICAL DOCTORS IN TREATING DISEASE

To the physicists this has opened up a golden opportunity of exploring the nucleus of the atom and the last few years have seen a great increase in our knowledge of the secrets in Nature's storehouse But not only the physicist was interested The doctor, too, saw immediately that here was something very valuable for him in the treatment of disease and as an aid in finding out what goes on in the human body

As an example let us look at radio-phosphorus, one of the most used of these artificial radioactive materials. It is made by shooting a neutron into the nucleus of ordinary phosphorus and has a half life of about two weeks, so it is very active for a few days It is given to an animal or a person, and then after a few hours, after a day, and after a few days the doctors make observations with electrical instruments to see how much of it has got into the bone marrow, and into other parts of the body They can tell by the rate at which it is taken up something about the health of the bones and organs

Because it is radioactive, this kind of

phosphorus not only shows its presence in very small quantities, but it does so from a distance If we fed a man ordinary salt which contains the element sodium and then wanted to know how long it would take before that sodium got into his finger tips, there would be no way of finding out But now we can have him drink a glass of water with salt in it that contains a tiny amount of radioactive sodium We find that after two minutes the radioactive sodium has arrived in his finger tips and is literally broadcasting" its presence there, by sending out rays and shooting particles into space In this way humans can serve as guinea pigs without the slightest danger to themselves, and we are finding out a lot of very interesting things about our bodies, in this case how fast our stomach can digest the sodium put it in the blood stream, and the blood stream carry it to our finger tips

These temporary radioactive elements can serve as a label or a tag on the ordinary elements, so we talk of tagging' or 'tracer" chemistry when we use them Radio phosphorus is one of the tags we use most, and through it we have found that our front teeth use nearly ten times as much phosphorus as any other bones in our bodies Also, when we use such radio phosphorus as treatment against a tumor, its radioactivity helps to kill the tumor, but because it has such a short half life, it does not cause any harm to the rest of the body afterward We could not give radium salts to a person because radium and all other normally radioactive elements are very heavy They never leave the body, and do a great deal of harm afterward by just being around If we can use the lighter elements temporarily made radioactive then they will leave the body afterward and do no harm at all

TRACER CHEMISTRY IS USED ALSO TO STUDY THE BLOOD, AND THE WAY PLANTS LIVE

Still other examples of this tracer chemistry are giving radioactive sulphur to rats and then observing how long it takes before it appears in their hairs, and giving radioactive iron to healthy dogs and to sick dogs suffering from anemia. In that way we found that the blood cells of the anemic dogs took up twenty times as much iron as those of the healthy dogs By giving radioactive iodine to humans we find that most of it goes to the thyroid gland

In the study of plants, too, these tracer materials are very useful We have known for a long time that in the green leaves of plants, sugars and starches are made out of water vapor and carbon dioxide from the air The botanist calls this "photosynthesis which means the putting together of complex substances out of simpler materials under the influence of (sun)light We know that it happens but how it is done we do not yet know By letting plants breathe radioactive carbon dioxide we now hope to be able to trace all the steps in between For another thing, we know that alfalfa can take the nitrogen gas out of the air and fix it in its roots, where later it acts as a good fertilizer in the ground by letting the plant breathe radioactive nitrogen we can follow the whole process in detail

THE ATOMIC BOMB WORKS BY THE PRINCIPLE KNOWN AS CHAIN REACTION

The most recent and the greatest discovery that has come out of radioactivity is the atomic bomb The whole story of that—or rather, as much of it as we are now allowed to tell—you will find elsewhere, but the early work done on it belongs in our present tale of radioactivity We have mentioned above that when we bombard atoms with alpha particles or with neutrons we can change them into different kinds of atoms Rutherford originally shot an alpha particle of weight 4 at a nitrogen atom, weight 14, and got oxygen, weight 17, and a proton weight 1 Chadwick shot an alpha particle (4) at beryllium (9) and got carbon (12) and a neutron (1) That is what usually happens first the two add up and then separate into two very unequal parts, the smaller one being usually of weight 1 But sometimes it splits evenly, as when we shoot a proton (1) at a lithium atom (7), for then we get two helium atoms (4) Or when we shoot a proton (1) at a boron atom (11) we get three helium atoms (4 each) Now all of these atoms are fairly light atoms, but when we try the same trick on the heaviest atom known, uranium, that is if we shoot a neutron (1) at a uranium atom of the weight 235, this splits nearly in two, producing one atom that weighs about 127 and one that weighs 104 There is no hard and fast rule about this and the pieces may differ a good deal at different times, though one is always a little heavier than the other But that is not all, 127 and 104 add up to only 231, the remaining 4 come out in the form of single neutrons—spare parts, we might call them But those spare parts are very important Suppose we hit 1 uranium atom with 1 neutron It falls apart and produces 4 more neu-

trons, these might hit 4 other uranium atoms, and each of those produces 4 neutrons, or 16 in all, these in turn hit more uranium atoms, each of which produces still 4 more neutrons and so on Of course, we do not always get such a perfect score, but you can see that we can well afford to have some misses. What it does mean is that once the splitting process has begun it carries on by itself because it produces its own neutrons, its own bullets, and goes faster and faster all the time That is what we call a chain reaction

Now when the uranium atom splits, it not only produces two new atoms, and some neutrons, but also a terrific amount of power

Out of one pound of uranium could come more than 10 000 000 kilowatt hours, enough to bring to boil 100 tons of cold water You can easily see then why people say that one pound of uranium in a bomb is as bad as 200 tons of TNT, one of our most powerful explosives No wonder people call the nucleus of such a heavy atom a power house so much energy is stored up in it that we even compare it to a volcano, since it needs only one little ' push ' to blow up with earthquake violence

Now some people think it is very wicked of the scientists to have invented the atomic bomb, and that scientists should have stopped before they got that far But we scientists believe that it is our task to find out more and more things in nature to learn as much as we can about what goes on in the universe We search for the truth only, and we can never stop halfway But how to use the things we have found out that is up to all *of us, as citizens and human beings* Many scientific discoveries can be used to do good or to do evil, and it is up to all of us to see that we use science only for good In the case of atomic energy it is you, who are now growing up, who will all have to help Make sure that it is not used to ruin our civilization, but to make it glorious

THE MYSTERY OF THE COSMIC RAYS WHICH ARE STRONGER FAR ABOVE THE EARTH

Here our story about radioactivity ends, but we feel that we should tell you about one more thing that may have some connection with it Cosmic Rays More than forty years ago scientists found that there were always some kind of rays going through their laboratories At first they thought that these came from radioactive materials, and since we know that we can stop alpha, beta and gamma rays by thick shields they first tried to put thick brick walls around their instruments, or sink them to the bottom of a deep lake, to surround them with many feet of water—but none of these things helped Then they tried to get away from the ground and take the instruments up in a balloon But instead of getting weaker, the rays got stronger, and finally Hess in Austria suggested that these rays must come from outside the earth Millikan in California then made some more experiments, he lowered his instruments into lakes in the Sierra Nevada mountains—Arrowhead and Muir lakes He found that these rays even manage to go through 100 feet of water, although *they are greatly weakened in so doing*

SCIENTISTS NOW THINK THAT COSMIC RAYS ARE REALLY PARTICLES AND NOT RAYS

At first we thought they were real "rays very much like X rays or gamma rays, but we now believe that they are mostly positively charged particles These are the original cosmic rays, or primaries, as we call them As they come down through the air they hit the atoms of the gases in our atmosphere and every time such a collision happens a gamma ray is produced, these we call secondaries, and about twelve miles above the earth there are many more secondaries than primaries As they all move lower down, the secondaries, which carry less energy than the primaries, get stopped by hitting other atoms And so by the time the rays get down to sea level the secondaries are nearly all gone again, and a good many primaries are gone, too There are about 100 times as many rays twelve miles up as there are at *sea level Because cosmic ray primaries* carry electric charges they curve around a magnet—and the earth is a magnet From this we can figure out that there should be more cosmic rays hitting the earth in the region around the Poles than near the Equator, and this is exactly what we find

Here on the earth, where we are so near the sun, we get a great many more light rays from the sun than cosmic rays But if we could set up a laboratory somewhere in the great empty space between the stars, then we should find that there are many more cosmic rays than light rays Where these cosmic rays come from we do not yet know Several guesses have been made—perhaps they come from "new" stars, which are stars that flash up suddenly due to a great atomic explosion within themselves, increasing their light 10 000 to 10 000,000 times in one night We have not been able to prove any of these theories yet—they are still guesses



Courtesy United States Rubber Company



Courtesy Firestone Tire and Rubber Company

Tapping for rubber in Sumatra (left) and Liberia (right) Latex from the cuts drips into little cups set below

RUBBER

By **E C McDowell**

THE world in which we live today would be very different and not nearly so comfortable without certain raw materials that play an important part in our ordinary daily life Among these basic raw materials are iron, cotton wood coal and rubber Some of these materials, such as iron and wood have been known and used from early times Rubber is one of the newer materials it was discovered about the time that Columbus discovered America and was actually one of the gifts that the New World brought to mankind

Natural rubber, which is also sometimes called India rubber, or caoutchouc, can be obtained from a large number of different trees vines shrubs and other plants Nearly all of the rubber of commerce however, comes from the rubber trees of tropical countries The Brazilian hevea tree is the chief source and its product is of the highest quality Nowadays hevea trees are grown in a number of different countries, but for a long time most of the rubber was exported from the seaport of Para in Brazil, and even today the product of the hevea tree is known as Para rubber

The rubber, or caoutchouc, is the gummy part of a thick juice called latex which is found in a spongy layer between the bark and the wood of the tree trunk We may think of this layer as a sort of inner bark The latex is a thick milky fluid, quite separate and different from the sap that flows through the wooden trunk of the tree The latex is obtained by making cuts through the bark into this layer but not deep enough to touch the wood Cups are then fastened below the cuts and the latex oozes out and drips into them

Latex is an emulsion like milk that is the tiny gummy particles of rubber are mixed with a watery fluid, and if allowed to stand these particles tend to rise to the top as cream rises to the top of milk The amount of rubber in latex varies from about 20 to 40 per cent Heating or mixing with acids, hastens the rising and thickening of the gummy substance When it has thickened into a spongy mass it is treated to get rid of the water, then it undergoes further treatment and is combined with sulphur It has now become the raw rubber of commerce and is quite different from the original gum, or caoutchouc

In recent years a great deal of the natural rubber has been grown in Malaya and the East Indies While the Japanese held these lands in the second World War, we were deprived of our supply of natural rubber Then

we vastly increased the manufacture of certain plastics from petroleum coal grains and other substances to take the place of natural rubber These plastics have become known as synthetic rubber None of these synthetic plastics is exactly like natural rubber but they can take the place of natural rubber in many uses



Screen Traveler from Gendreau

Preparing rubber in Sumatra Here the latex in pans is exposed to the sun. Part of the liquid evaporates.

Rubber has become one of the necessities of modern civilization because it has so many and varied qualities For example its frictional quality makes it tend to cling to any surface on which it is pressed or rubbed It is this quality that caused it to be called rubber in the first place All boys and girls know that if you rub it lightly over paper it will cling closely enough to the surface to rub off pencil marks and soiled places This same quality is what makes non skid tires stick to the road gives us non slip rubber heels and soles for shoes, and makes rubber floor coverings and mats safer

Its wonderful elasticity gives it two of its most valuable qualities it can be stretched almost to the breaking point, and when let go will snap back to its normal shape and size and when it is compressed it will absorb vibrations and bumps and shocks It is a non-conductor of electricity it is waterproof and it is not affected by most acids and alkalis except very strong ones Alcohol will not dissolve it It is soluble in turpentine and vegetable oils and in naphtha benzine carbon bisulphide and other volatile liquids which evaporate quickly and leave the rubber as it was

When rubber is used as a cement or glue or is applied in liquid form to cloth or other materials it dries, sticking very tightly to the material it is applied to It is a poor conductor of heat and does not burn easily In a plastic state it can be formed or molded to any shape and then hardened By treating it with sulphur in a special way it can be made into a hard, tough substance called vulcanite or ebonite In this state it has no elasticity and can be machined or carved and polished and is much like ivory or horn

Another valuable property of rubber is that it does not lose its elasticity in cold (except extreme cold) and it stays elastic under moderate heat up to about 160 degrees F It is durable if protected from the air When it is exposed to the air for a long time it gradually loses elasticity and begins to get crumbly

These qualities have made rubber useful to us in the most astounding number of



Screen Traveler from Gendreau

The spongy latex is now passed through wringers.

ways both big and little The motor car industry is the largest user of rubber for tires and inner tubes and also for smaller things such as windshield wipers insulation for electric wiring floor mats and a number of little gadgets The electrical industry uses an enormous amount of rubber, of course because it is a non-conductor and can be used for insulation to direct the electrical current in its proper way and for safety's sake Wherever electricity is used rubber is used

We use it to waterproof clothing, shoes and boots, and special sheets or blankets for hospitals or for soldiers and campers One of the most important uses is for hose to carry water and other liquids Fire hose is as necessary as water to protect our towns and factories and everything else that may be destroyed by fire Every house that has plumbing fixtures and pipes for water has rubber washers or gaskets to make watertight joints in the pipes

WE DEPEND ON RUBBER TODAY FOR THOUSANDS OF USES

If you were to notice and count everything that you see or touch in one day that has rubber in it, you would wonder what our way of living would be like if all the rubber were suddenly to vanish Some of the small but important uses will give you an idea of its widespread use For example, there are the many kinds of rubber stamps used by the post office to cancel postage stamps, stamps used by banks and stores and other businesses to mark papers the rubber in balls for all kinds of games and sports the rubber in toys and playthings, elastic bands and erasers on pencils

There are floors, floor coverings and mats made with rubber, also carpeting which is made of wool fibers set in rubber covered burlap In fire hose, tires and other articles where great strength is required, cords or stout fabrics are embedded in the rubber For many purposes pure rubber is not necessary For instance, in floor mats or molded articles fillers are used to give more bulk and the rubber serves as a plastic binder Worn out rubber articles are not a total loss, as the rubber can be dissolved and used over again This is known as reclaimed rubber, and it is used chiefly for goods of inferior strength Reclaimed rubber is also used to mix with pure rubber for articles such as tires The recovery of scrap (old) rubber makes an important saving in the use of natural rubber

One valuable quality in natural rubber is that it will mix, or combine, with some of the synthetic rubbers and give them certain qualities which they lack. As we know, it stands up well under heat it has been found that some types of synthetic rubber used for automobile tires tend to heat up and lose strength, especially tires on heavy trucks The addition of about 30 per cent of natural rubber overcomes this loss of strength For inner tubes nothing has been found or made quite so good as natural rubber

There are many hundreds of different trees, plants, shrubs, vines and even vegetables that have latex containing a gummy substance of the nature of rubber, or caout chouc Of all these, however, less than a dozen have been used to any extent as a source of commercial rubber Until about the beginning of the twentieth century rubber came from trees and plants found growing wild in tropical and semitropical regions of South America Africa, India the East Indies, Central America and Mexico This is known as wild rubber

Our century has seen the development of large plantations in which the trees are carefully cultivated Millions of acres were under cultivation when war started in the Pacific in 1941, and these formed the chief source of natural rubber It has taken immense sums of money to establish these plantations, as the land must be cleared and seedlings set out in rows like vast orchards It then takes seven or eight years before the trees can be tapped for the latex and the quality and amount obtained increases as the trees grow older This 'plantation rubber is of highest quality, as only the best varieties of trees are planted, and the rubber is free from dirt, bark and other impurities The best rubber is obtained from the older and larger trees The more important sources of natural rubber are as follows

The Brazilian hevea rubber tree is most important, growing wild throughout the valleys of the Amazon and its tributaries and in the adjoining countries of Peru, Colombia Venezuela and the Guianas This is, as we have said, the original source of Para rubber which ranks highest on the market It is also the species of rubber tree that has been most used to form the great plantations of cultivated trees in Ceylon, Malaya, Africa and the East Indies, and more recently in Brazil

LATEX CAN BE OBTAINED FROM A NUMBER OF TREES AND PLANTS

The manihot tree from which Ceara rubber is obtained is also a native of Brazil The latex of this tree does not flow so freely as that of the hevea tree, and the rubber obtained from the wild trees is not so well prepared and has more dirt and bark in it The trees of this variety that have been planted in plantations in Ceylon and East Africa yield a better quality, but it does not have the market value of Para rubber

The castilloa tree of Central America and Mexico is the source of Ule rubber It is usually of a darker color and has impurities in the latex that cause it to have less strength

than the Para rubber This tree has also been cultivated to some extent

The tree which is commonly known as the rubber tree or India rubber tree and cultivated in America and England as an ornamental plant is a native of Assam and India where it grows to a large size It has furnished most of the wild rubber of India Sumatra and Java but because of the careless methods of collecting the latex it has much impurity Where improved methods are used the rubber is of good quality

THE SILK RUBBER TREE AND OTHER WILD SOURCES OF LATEX

The native African rubber tree commonly called the silk rubber tree produces what is known as Lagos rubber This is of good quality but like other wild rubbers has impurities that lower its value There are a number of other trees which have been planted experimentally and have in some cases shown very good results

Besides trees there are vines and climbing plants in tropical Africa and Asia which produce a latex from which a good quality of rubber is obtained The difficulty with these is that the vines are liable to be injured or killed by careless tapping Then too the vines are so widely scattered in the forest that tapping and gathering the latex is slow and laborious The most important of these vines is the landolphia vine of Africa Other species of rubber producing vines are found in South America In Borneo much of the wild rubber exported has come from other species of these vines In the Congo and the South Sudan in Africa the natives prepare a root rubber from the roots of the landolphia and other vines The roots are crushed in hot water and the rubber then separated from the fibers The ecanda plant of Portuguese West Africa (Angola) has tuberous roots from which the rubber is extracted in a similar way by the natives

THE RUSSIAN DANDELION A SOURCE OF RUBBER IN TEMPERATE CLIMATES

The Russian dandelion or kok saghyz, is a non tropical source of rubber The roots are treated in a similar way to other root plants but modern machinery is used to crush the roots and carry on the preparation This plant has been used in Russia with considerable success and during World War II the American and Canadian governments financed the planting of experimental fields from Quebec and Vermont to British Columbia and Oregon

The guayule plant is a shrub native to northern Mexico and its wild growth extends across the Rio Grande into the Big Bend area of Texas In 1910, when rubber production was much less than it has since become the guayule shrub produced about 10 per cent of the world s rubber The rubber is obtained by breaking the stems of the plant and then crushing by machinery in order to extract the rubber This rubber has about 16 to 20 per cent of resins which are easily separated The United States Government fostered the planting and cultivation of 30 000 acres in California and other southwestern states The cultivated guayule produces more than twice the amount of rubber per acre than the wild variety does

Other sources of natural rubber which have been sponsored by the United States Government include a species of golden rod with which Thomas A Edison made some experiments on a 600 acre farm in Georgia Edison was able to produce 100 pounds per acre on poor land The desert milkweed the wild rabbit bush and the one year castilla are also being experimented with and in Haiti the cryptostegia has been put under cultivation

The world production of rubber in long tons (2 240 pounds) is given in the following table from a report of the United States Department of Commerce

FAR	ASIA AND EAST INDIES	AMAZON VALLEY	MEXICAN GUAYULE	AFRICA	TOTAL
1910	10 979	37 938	9 542	20 143	94 013
1920	305 106	23 216	982	6 402	341 994
1930	802 092	14 260	1 093	3 961	821 914
1940	1 353 052	17 161	3 634	16 314	1 390 661

In 1910 the rubber produced was nearly all wild rubber Since then the great increase has been almost entirely in Asia and the East Indies where large rubber plantations have come into bearing during the years This table shows the rapid falling off in wild rubber production until the outbreak of the war in the Pacific Since 1940 some plantation rubber has come into the market in South America and Africa

The production and preparation of rubber varies very much depending upon the kind of tree or other source the rubber comes from From the shrubs and vines the rubber is obtained by crushing the stems or the roots and mixing with hot water to separate

the rubber from the fiber This, of course destroys the plant From the rubber trees the latex which contains the rubber is tapped periodically, and in that way the tree will produce for many years provided the tapping is done carefully

Originally the natives gathering rubber from the wild trees in the forests used small axes to cut through the bark into the latex bearing layer beneath but they often cut too deep into the wood of the trunk This permitted fungus or rot to attack the wood and eventually the tree died

On plantations where most of the rubber is now produced special tapping knives are used to keep from cutting too deep Several methods of tapping have been in use One



Mixing sulphur with crude rubber in the mill rolls.

is to make V shaped cuts on four sides of the tree and place small cups at the point of the V to catch the latex Another method is to make a series of V-cuts in a vertical line, up and down the trunk all of them connected by a vertical cut which leads like a trough down to the base of the tree where the cup is placed This is called the herringbone system More approved methods are the later spiral methods of tapping

The latex is gathered into buckets, or carried in tanks to a central station where the rubber or caoutchouc is separated from the watery fluid The rubber from some varieties of trees can be separated by a machine but with latex from the hevea tree acid liquids are added to make the rubber coagulate that is come together in a spongy mass. The rubber is then washed and dried and cut up and passed through grooved rollers in a washing machine coming out in sheets or crinkly ribbons These are dried and are compressed into blocks or other shapes

The original native way of preparing the rubber for shipment was to use a stick or paddle which was dipped into the latex and then held and turned in thick smoke from a small fire The thin layer of rubber would dry and would also absorb some of the smoke The paddle would be dipped and dried in the smoke again and again till a large ball of dry smoked rubber was built up on the paddle The creosote in the smoke acted as a preservative as it does in smoked meats fish and the like The rubber prepared in this crude way was of a high quality

Modern methods now keep latex liquid by the addition of ammonia and then it is shipped long distances in tanks on ships or in tank cars to factories where the rubber is separated Then it goes through machines which wash dry and further treat it This rubber or caoutchouc is not yet the rubber we know It is still gum



Both photos, courtesy of United States Rubber Company

Calendering, or pressing the rubber into smooth sheets.

THREE PLANTS THAT YIELD RUBBER



U. S. Forest Service photo

A field of five-year-old guayule in the Salinas Valley of California. The guayule plant is a shrub native to northern Mexico and southern Texas. It has also been cultivated in California and other southwestern states. It yields a good grade of rubber



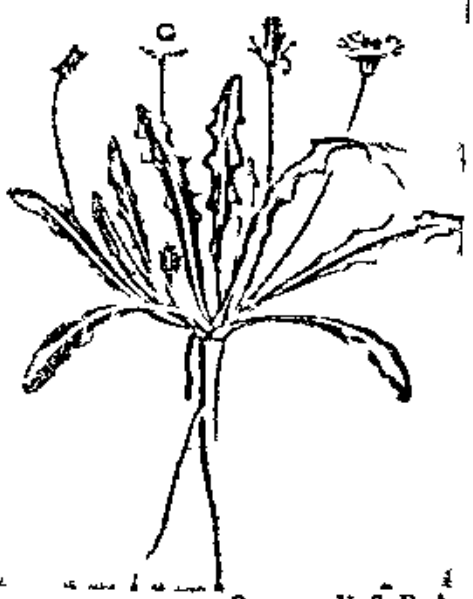
U. S. Forest Service photo

Close up of a guayule plant. The rubber is obtained by breaking the stems of the plant and then crushing by machinery



Courtesy United States Rubber Company

The cryptostegia cultivated in Haiti for its rubber. When a leaf is broken or a stem is cut, the latex forms in wee drops.



Courtesy U. S. D. A.

Russian dandelion or kok saghyz. This plant is a non-tropical source of rubber

my and if warmed it gets sticky It must be combined with sulphur to give it toughness and solidity and the elasticity which is its chief quality This process is called vulcanizing When it is combined while heated with 2 5 to 10 per cent of sulphur we get the ordinary rubber of different degrees of elasticity If it is brought to a greater heat and combined with about 30 per cent of sulphur the rubber becomes the hard tough material known as vulcanite or ebonite This can be molded while it is still soft or when hard it can be carved or machined The production of plantation rubber brought with it an era of scientific research and invention in which crude hand methods were largely done away with

HOW THE PLANT BREEDERS IMPROVE THE QUALITY OF OUR RUBBER

Rubber plantations today are the result of more than sixty years of experimenting and of scientific plant breeding Seeds for planting have been continuously selected from trees that showed the highest yield of latex of the best quality To avoid insect pests and diseases that attack the roots of high yield trees plants are selected from hardy varieties that are immune to such pests and diseases and when these plants are well established buds from the high yield trees are grafted on to the hardy plant near the ground so as to form the trunk of the full grown tree from which the latex is obtained

BUD-GRAFTING MAKES THE TREES IMMUNE TO PESTS

In some regions which have the right soil and climate there are unfortunately pests which attack the leaves To meet this threat as soon as the young tree is big enough another variety is bud grafted at the top of the plant This gives a healthy leaf structure which is immune to the pests This method of grafting of rubber trees to secure a high yield and have trees which are immune to leaf and root diseases was started in the early 1920 s and records show that while the average yield of trees grown from seed was 300 pounds per acre the average yield of trees that had been bud-grafted was 1 000 to 1 700 pounds per acre

Some of the rubber plantations include several million acres not all planted in rubber but with large areas of the most suitable land cleared and the trees planted in rows The trees are about 15 feet apart in the rows and the rows are 13 feet apart which makes about 220 trees to the acre As the seeds spring up the seedlings in each seed bed are thinned out leaving at the end of the year only two of the strongest plants to each bed These are bud grafted and the one that is most successful is left standing

REGULAR TAPPING DOES NOT BEGIN UNTIL THE TREES ARE EIGHT YEARS OLD

About five years after bud grafting the tree is tall enough for a test tapping to be made This is continued from time to time during the following three years or until the tree has reached the size for regular tapping During this time the trees which do not come up to the required standard of yield and quality of latex are removed This reduces the number of trees per acre to about 100 though the growth of the trees varies in different regions It is greatest where the rainfall is most regular This in outline gives some idea of the long process to be gone through before any rubber is produced at all As the trees grow older and larger the yield of latex becomes greater The planting and raising of the trees is only a part of what must be done to bring a modern plantation into production and to maintain this production

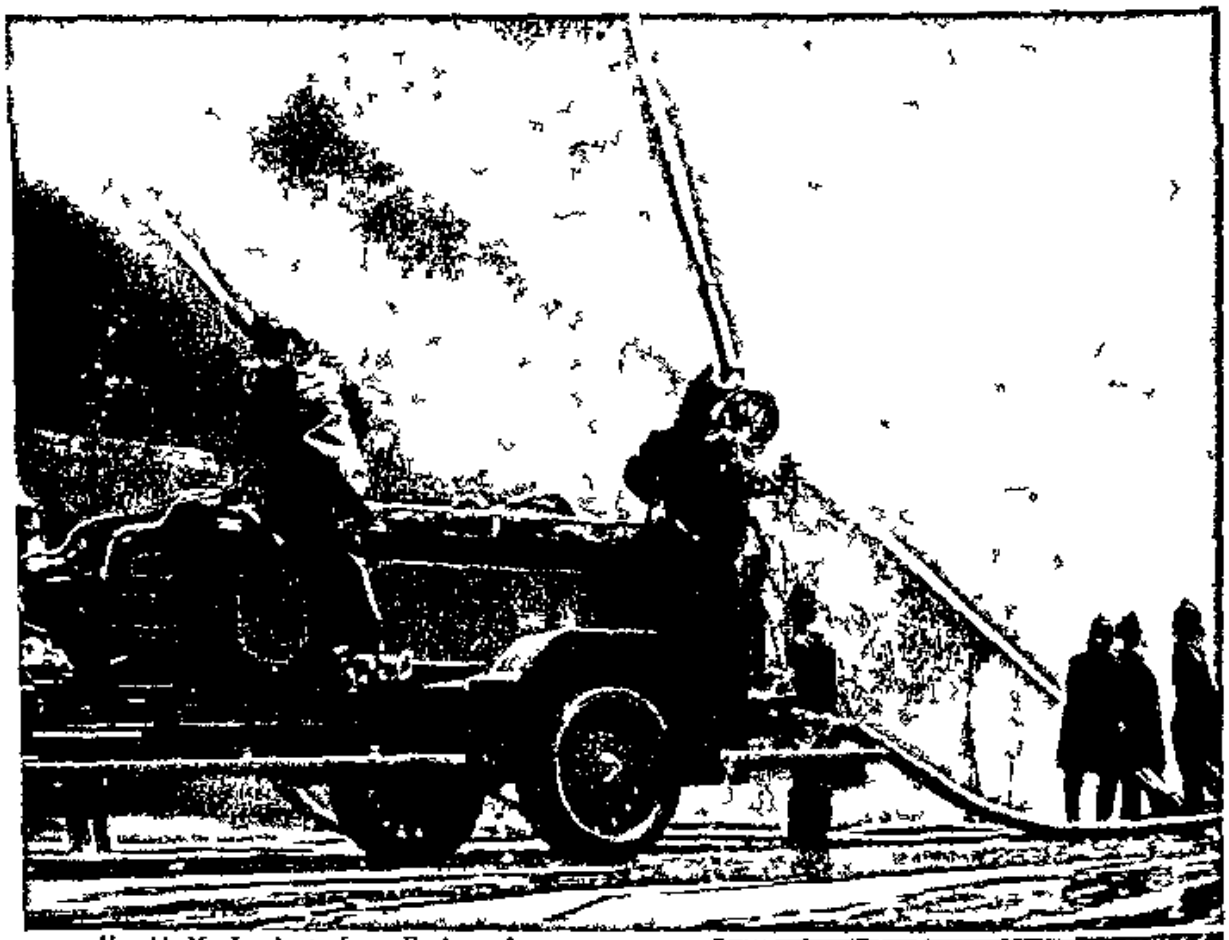
The largest most numerous and oldest plantations are in the East Indies and southeast Asia British companies have plantations in Ceylon India Malaya and Borneo and some in Africa French companies have plantations in French Indo-China and Dutch companies in Sumatra and Java

Only in recent years have American rubber companies established plantations to supply their needs In 1925 the Firestone Rubber Company leased about a million acres in Liberia in Africa By 1941 there were nearly 100 000 acres under cultivation and the acreage has increased each year since In 1928 the Ford Company secured a concession of about 2 500 000 acres in the Amazon Valley in Brazil and by the time war broke out had begun limited production

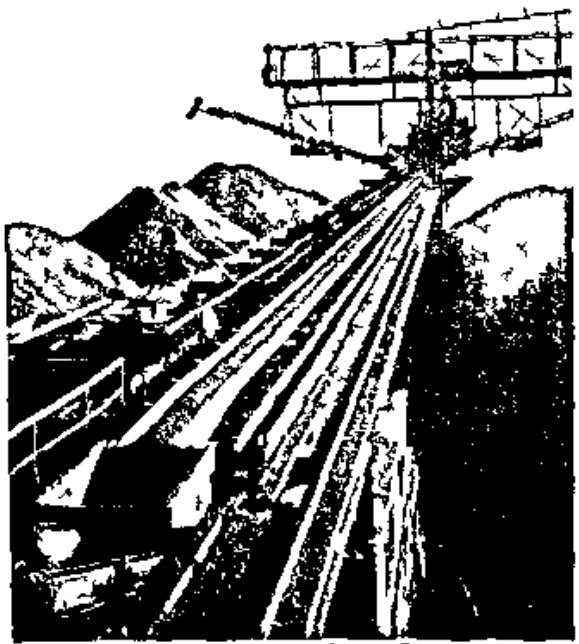
MORE THAN HALF OF THE WORLD S PRODUCTION IS USED BY THE UNITED STATES

In 1940 the United States took 811 000 tons of the world s production of 1,390 000 tons of rubber, and of this 777,000 tons came from the East Indies and Asia This was nearly all plantation rubber and the supply was cut off by the Japanese To replace this supply a great program for making synthetic rubber was adopted and encouragement was given to the development of plantations of guayule, Russian dandelion

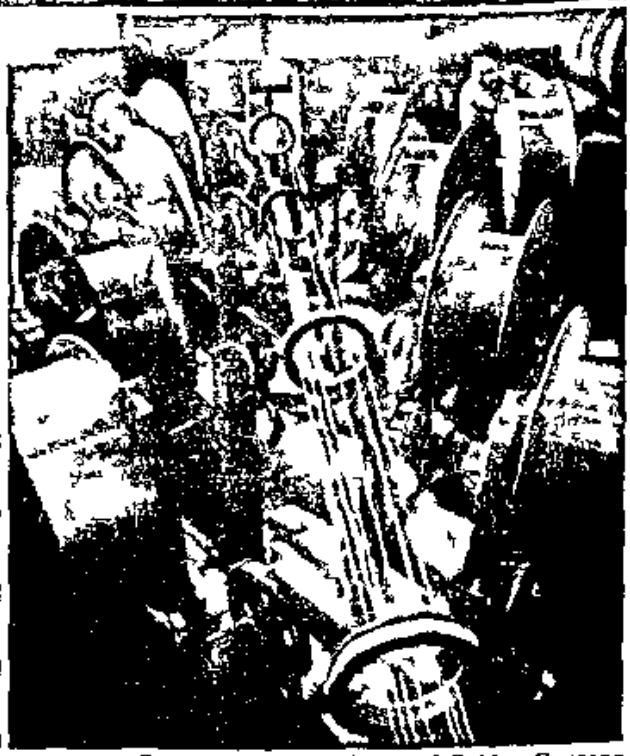
SOME MODERN USES OF RUBBER



Harold M Lambert f om F eder c Lew s
Articles of rubber form an important part of the fire fighter's equipment Helmet, coat boots hose line truck tires—all are made of rubber



Courtesy Un ted S ates Rubber Company
Rubber conveyor belt used in loading coal Conveyor belts are widely used in modern industry



Courtesy F restone T re and Rub ber Company
Building up tire beads The beads, which fit on the wheel rims are made of tough steel wire set in rubber

and other quick growing plants By these means it was hoped that a permanent home supply of rubber might be established This supply might not entirely take the place of the Asiatic rubber, but once established, it would give a certain independence and could be expanded in any future emergency The plants we have mentioned will give a much greater yield of rubber after some years of careful selection of seed and cultivation

The story of rubber goes back, as we have said, to the time of the discovery of America. The historian Herrera, who wrote the account of Columbus's second voyage, tells of the elastic balls made from the gum of a tree and used by the natives of Haiti in their games The Spaniard Juan Torquemada writing in 1615, tells of the rubber tree in Mexico and of the native method of getting the gum to coat shoes The Spaniards themselves were soon using the gum to waterproof cloaks About 1735 the French government sent De la Condamine on a scientific expedition to South America While there he investigated this elastic gum and wrote a complete account of his findings He called the gum caoutchouc, which is the French way of spelling an Indian name for it

In 1770 Joseph Priestley, the English chemist found that this gum made an excellent rubber to rub out pencil marks In telling about it Priestley mentioned that a small cube of about one half inch dimensions could be bought for three shillings That would be about seventy five cents today but the amount had much greater purchasing power then Artists and a few other people began to use the gum for erasing marks but that was the only use for it known Since the French name caoutchouc was difficult to pronounce and to spell the English came to call it by the simple name rubber'

WATERPROOFING CLOTHES WAS THE FIRST IMPORTANT USE OF RUBBER

The fact that the gum was waterproof led Samuel Peel, about 1791, to invent a way of waterproofing clothes by dissolving the gum in turpentine and spreading it on cloth In 1823 Charles Macintosh thought of a better way of waterproofing He used the gum to cement two pieces of cloth together, thus doing away with the sticky outside surface That is why to this very day raincoats are often called mackintoshes in Britain

The great trouble about all such uses of rubber, or caoutchouc, was that in damp, warm weather it became soft and sticky and in cold weather it became stiff Many inventors tried to think of ways to overcome this drawback, and among them were Charles Goodyear of the United States and Thomas Hancock of England

After much labor and experiment Goodyear, about 1843 discovered that the gum if moderately heated would absorb sulphur and that even in small amounts the sulphur would make a remarkable change in the nature of the rubber The rubber would lose its stickiness and become far more elastic and it would keep its elasticity even in very hot or very cold weather Hancock the English man, working independently added to this discovery and did much to make the new product a commercial success This process is called vulcanizing

VULCANIZING MAKES RUBBER FAR MORE USEFUL

The discovery of vulcanizing marks the beginning of the use of rubber on a wider scale New uses were found for it and the production gradually increased In the last part of the nineteenth century electric light and power systems began to spread over many countries, and this greatly increased the demand for rubber Rubber tires began to be used for vehicles especially bicycles first solid tires and then hollow tires filled with air—or pneumatic tires Then came the growth of the automobile industry in the twentieth century and the need for rubber tires became enormous

It usually happens that when there is a strong need for improvement in any article people get busy to bring about the improvement The demand for a better quality of rubber in the last part of the nineteenth century brought about the establishment of plantations for the planting and cultivation of superior trees The rubber of Asia and the East Indies was not so good as that of Brazil, so an Englishman, H A Wickham went to Brazil and collected seeds of the hevea tree He had to smuggle them out of the country, as the Brazilians had a monopoly of good rubber and it was forbidden to export seeds or plants The seeds that Wickham took were planted in greenhouses at Kew Gardens, in England When the seedlings grew they were carefully packed and shipped to India Ceylon and Singapore and set out on specially prepared land From these seedlings grew the huge system of rubber plantations of the East Indies that produced at the time of the Japanese invasions more than 95 per cent of the world's rubber supply

SCIENCE

BIOLOGY

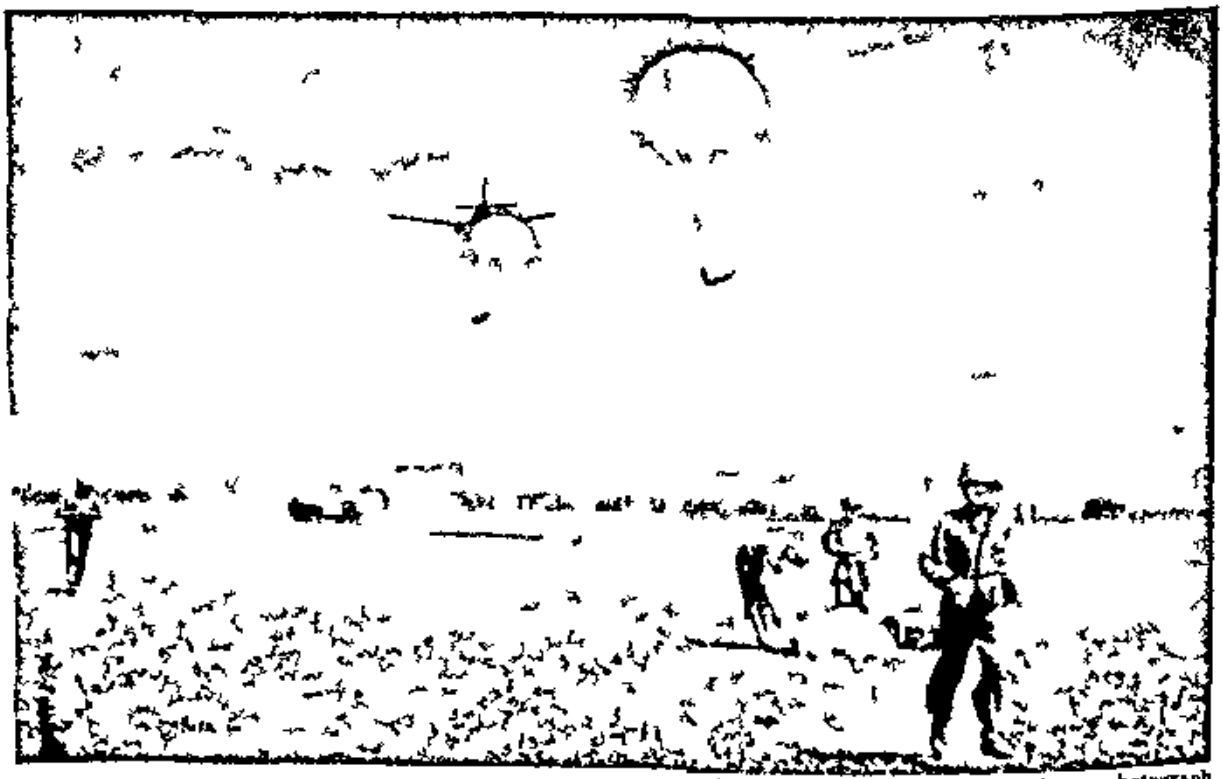
By Thomas Gordon Lawrence

GREAT advances were made during 1945 in the medical sciences and in experimental biology both in the United States and abroad Biologists learned how to transplant whole organs from one animal to another always with the hope that the same procedures will be successful with human beings In 1944 Professor Nikolai Sinitsin of Moscow Russia performed the sensational experiment of removing the heart from a frog and then inserting a new heart from another frog

In 1945 Sinitsin transplanted new hearts into warm blooded animals—dogs cats and rabbits In these animals the original heart was not removed so that after the operation each animal had two hearts both pumping away as if nothing had happened The method is so simple that the whole operation is carried out in half a minute or less So far no ill effects have been noticed in the animals In the case of the frogs where new hearts were substituted some of them lived until the following spring and laid their eggs just like normal frogs Very little blood is lost in the operation

Another discovery which should be good news for persons who lose their teeth was carried out in New York The teeth of men and of animals such as cats and dogs first start to grow as little tooth buds or germs Dr Harry Shapiro removed some tooth buds from week-old kittens and transplanted them into the mouths of other kittens or grown cats which had lost some of their teeth All of the buds grew to full sized teeth It is thought that it should *eventually* be possible to take badly overcrowded teeth from a child's mouth and plant them in the mouth of an older person who has lost some teeth

A method of successfully welding large arteries together with vitallium a non irritating surgical alloy came into use during the year Results were much better than with the previously used method of attempting to



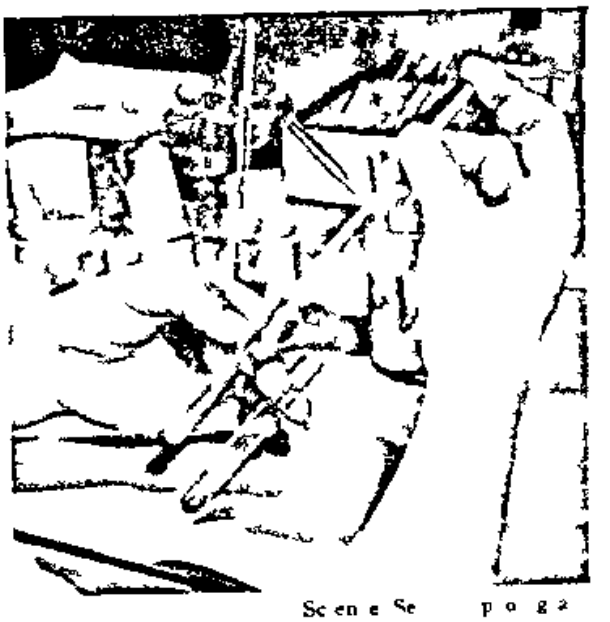
Official United States Marine Corps photograph

Bundles delivered by parachute to American Marines on Iwo Jima. Much blood plasma was dropped in this fashion.

sew together the cut ends of the artery

Advances continued in the u e of parts of the blood in medicine and surgery Gamma globulin, a by product of blood collected by the Red Cross for the fighting forces was found to provide a weapon against infectious jaundice It was also said by doctors to be the material of choice in protecting babies and young children against measles In an experiment it was found to give complete protection to 39 per cent of the children injected with it

Fibrin film the solid elastic material developed from blood plasma was used for many new purposes In head wounds when fibrin film was used to cover the exposed brain it was found to prevent scar formation and the convulsions which are often a serious aftermath of gunshot wounds in the head



Scene Se page 2

Blood is tested to see if the Rh factor is present.

KNOWING IF A PERSON HAS OR HAS NOT THE RH FACTOR IS IMPORTANT IN TRANSFUSIONS

Progress was made in unveiling the mystery of Rh the blood factor discovered by Dr Philip Levine eight years ago Persons with the Rh factor are said to be Rh positive those lacking it are Rh negative A transfusion of Rh negative blood does not injure an Rh positive person The *first* transfusion of Rh positive blood does not injure an Rh negative person, but this transfusion causes the production of substances in the negative individual s cells which may cause a violent, and often fatal reaction if a *second* transfusion of Rh positive blood is given

Intensive research continued with new antiseptics especially the marvelous juice produced by a common green mold—penicillin Although penicillin is actually effective against only a few types of bacteria it is now established as an effective remedy against carbuncles blood poisoning some heart infections some pneumonia some meningitis anthrax and some gas gangrene Neither penicill n nor sulfa drugs cure or prevent tuberculosis leprosy typhus typhoid virus diseases, malaria or the common cold

THE MEN WHO BROUGHT PENICILLIN TO THE WORLD WERE AWARDED A NOBEL PRIZE

The 1945 Nobel Prize in physiology and medicine was given to Sir Alexander Fleming of London University the discoverer of penicillin and to Sir Howard W Florey and Dr Ernst B Chain of Oxford University who helped develop it as a lifesaving remedy

Substances similar to penicillin in their effect on germs were found in water chestnuts burdock buttercups a microscopic green plant called Chlorella in the athlete s foot fungus and in bacteria growing in the soil Streptomycin produced by a soil bacillus was found to be very effective in checking the growth of certain germs

Attacks by sharks on shipwrecked sailors or airmen can now be prevented by using a newly developed substance It is a stink bomb composed of substances taken from the bodies of dead sharks The live monsters swim away to avoid any contact with the material

In the field of vitamins folic acid one of the vitamin B group was synthesized (made artificially) for the first time It was found that folic acid swiftly increases the number of red blood corpuscles and is helpful in pernicious anemia One investigator claimed that injections of folic acid caused certain cancers to disappear in 43 per cent of mice so diseased

It was already known that by no means all of the bacteria in our intestines are enemies some of them manufacture vitamin B (thiamin) Now it has been discovered that our intestinal bacteria also make riboflavin (vitamin B_2 or G)

The remarkable ability of some organisms to endure unfavorable conditions was illustrated when glass tubes in which mushrooms had been sealed thirty five years ago were opened Although the air pressure in the tubes was only about $\frac{1}{7600}$ of normal, it was found that the mushroom caps were still capable of reproducing

SCIENCE—CHEMISTRY

By Morris Mondzak

WITH the end of the war important facts concerning recent developments in chemistry were revealed to the public. Among them were details regarding DDT. This is in its pure state an odorless colorless crystalline solid whose full name is dichloro diphenyl trichlorethane. Although DDT had been first compounded back in 1874 it did not become important until during the war when it was found to be most effective as an insecticide (insect killer).

Before American troops invaded a tropical island airplanes would spray DDT on the beachhead to kill malaria carrying mosquitoes. The success of this procedure is shown by pictures of troops playing ball bareheaded and with sleeves rolled up near a tropical lake without the use of DDT such activity would have been both uncomfortable and dangerous.

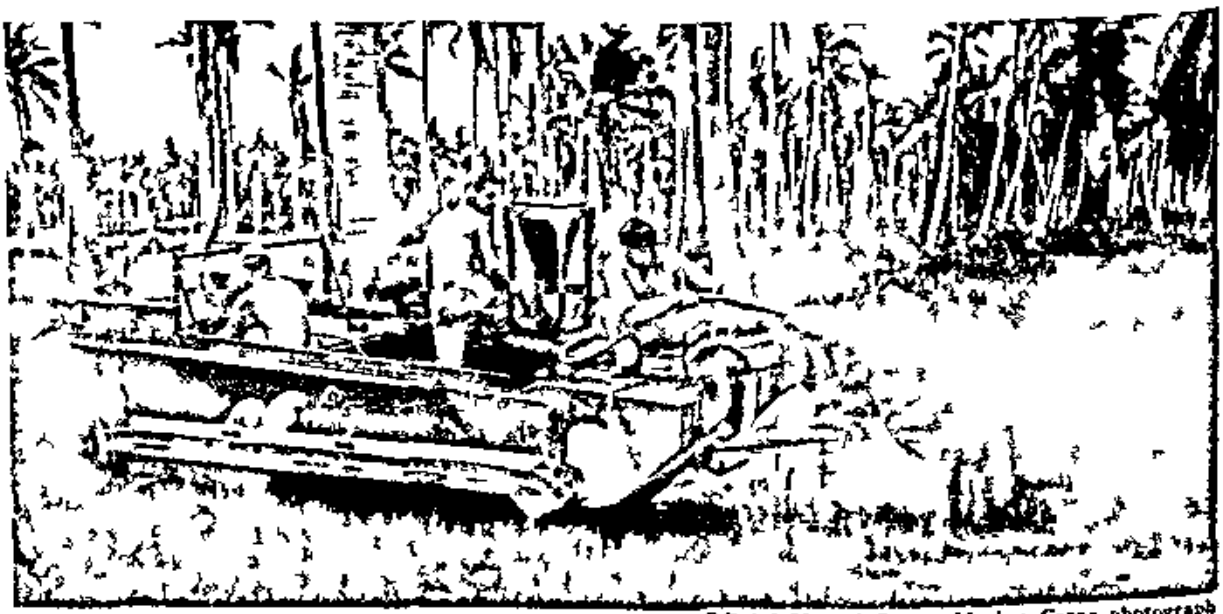
So far DDT has been used successfully against the mosquitoes that carry malaria and yellow fever and against the insect carriers of typhus dysentery and African sleeping sickness. It also works against some nuisance pests such as bedbugs and body lice. In view of this success there is hope of completely wiping out some of the most dangerous pests. It will be a great triumph if insects which carry the germs of such diseases as malaria can be exterminated for then these diseases would disappear due to lack of a carrier.

Insect aerosol bombs which are small cans containing a gas loaded with DDT or some other insecticide (such as pyrethrum) are being sold to fumigate whole rooms or portions of a garden. When the bomb is opened the gas fills a room in a few instants. DDT is also effective when used in paints and wall finishes of the water solvent variety.

Fifteen pounds of DDT dissolved in freon and released as a fine spray are as effective against Japanese beetle larvae as 1 500 pounds of arsenic compounds. In many areas fruit and shade trees have been completely protected from the destruction caused by the gypsy moth.

Many other chemical formulas were developed during the war to fight insect pests. NMRI 407 whose formula is still a secret kept mosquitoes at a respectful distance from our jungle fighters for five hours after one application.

ANTU (which is short for alpha naphthyl thio urea) was discovered through experiments on the sense of taste in a psychology laboratory. Although not dangerous to human beings ANTU is a most powerful poison for rats one hundred times as effective as arsenic compounds. Within two or three



Official United States Marine Corps photograph

A home-made DDT duster which was designed by an officer serving in the Russell Islands is used to spray a pond.

days the entire rat population of a city could be destroyed and an epidemic of typhus or the plague controlled

In recent years many new textiles have been made from compounds of such unlikely materials as the casein of milk, and coal air and water In 1945 more new artificial fibers were introduced A soft cloth with a greater dry strength than wool was made from chicken feathers millions of pounds of which are now thrown away or used as fertilizer Dental towels almost as cheap as paper were produced by cementing together cotton fibers with plastics In this case for perhaps the first time in the history of the world (with the exception of the cloth made in some tropical countries by pounding the bark of a tree), cloth is made without having to spin and weave

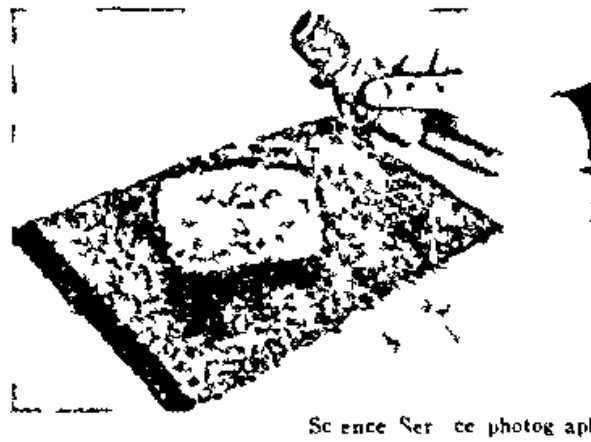
Other fabrics have been improved so as to make them water repellent, fireproof and weather resisting They possess greater strength, durability and warmth and are less given to wrinkling shrinking and losing shape Linen tablecloths were coated with a transparent film of vinyl butyral Gravy spilled on such cloth may be wiped off with a damp rag, ink may be removed with a stream of water, leaving no stain

A new chemically treated cotton (related to celanese) will not rot even though kept moist, may be used for awnings and fish nets is fire-resistant and may be used for upholstery

Glass fibers are being used more extensively for clothing Exceedingly soft and springy cushions have been made of glass wool

MATERIAL FOUND IN WOOD PULP AND SAW DUST IS USED TO MAKE A NEW PLASTIC

The war made the waste found in some of our essential industries seem a really shocking thing One material which was formerly thrown away, the essential part of wood pulp and sawdust called lignin, is now being used to make a shiny, black plastic, to condition soil and to control dust on roads When paper is made from wood pulp, great quantities of lignin are left unused A fine quality, hard wallboard is now made from wood shavings, chips and sawdust by treating these materials with chemicals and compressing them By treating soft woods with the chemical methyl urea we can make them as hard as oak or walnut These woods may be made to resist fire and decay, may be dyed beautiful colors and may be coated with stainless steel and other metals



Science Service photograph

Shown here is a piece of chicken feather cloth a pile of the feathers and a roll of the yarn which is made by binding the feathers with a little wool

A new group of substances called silicones some of which bounce like rubber but can be shaped like putty were recently developed Active research continued in this field during 1945

Some large scale experiments in hydroponics (soilless chemical gardening) were carried out Ascension Island, a pinpoint of rocky, dry desert land and cactus in the South Atlantic Ocean, now produces lettuce tomatoes radishes, cucumbers and green peppers The Army established hydroponic gardens there using water distilled from the ocean to water the plants that are rooted in the gravel of the island Asphalt like concrete is used to keep the water from sinking into the dry ground The gardens are arranged in descending steps so that the drained off water may be used again Since some of the plants would not produce fruits unless insects transferred their pollen whole hives of bees were shipped to the island

In the process of making the atomic bomb two entirely new chemical elements were produced These two are neptunium (with 93 protons in the nucleus) and plutonium (with 94 protons) Previously the element with the highest atomic number was believed to be uranium (with 92 protons) At the time the news of the bomb was released it was assumed that man had succeeded in creating two new elements which did not exist in nature. Toward the end of 1945 reports were printed revealing that small quantities of plutonium had been found in nature and that two more new elements, numbers 95 and 96, had been created in the laboratory If these reports are confirmed it will mean that in one year four new chemical elements have been added to the list of ninety two, which for so long was considered complete

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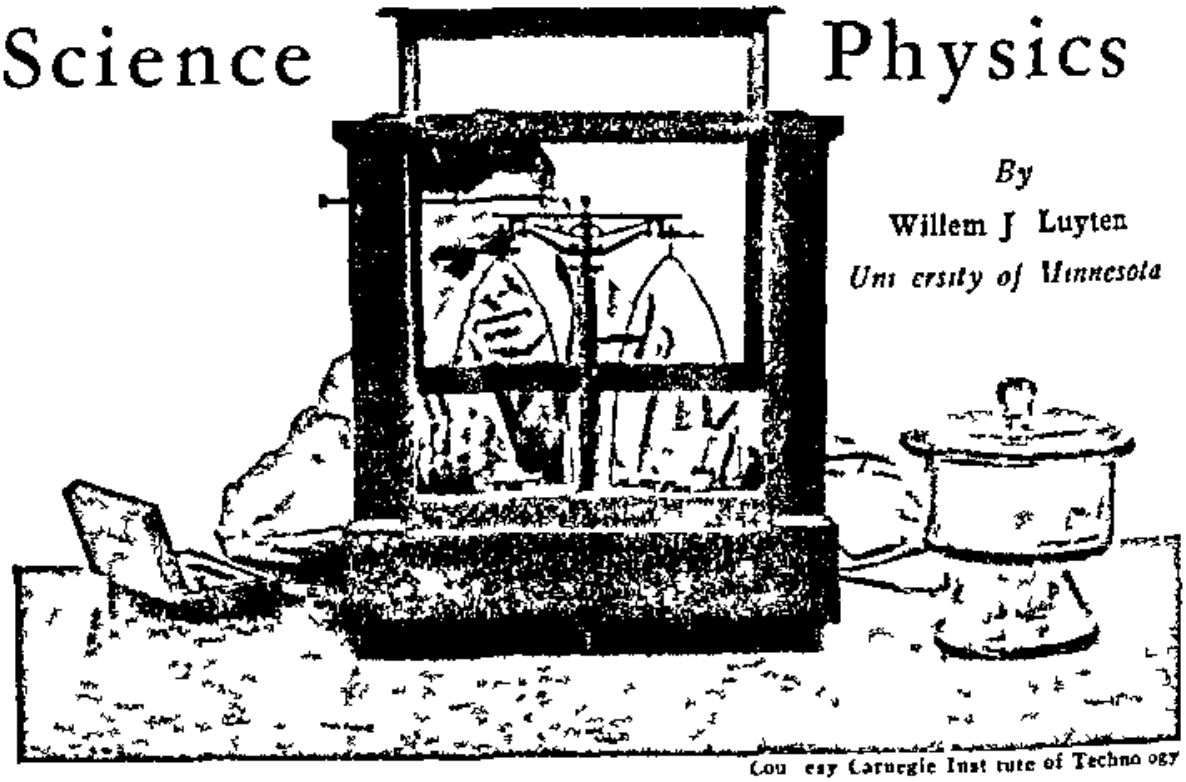
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Science Physics

By
Willem J Luyten
Uni ersity of Minnesota



Cou esy Carnegie Inst tute of Techno ogy

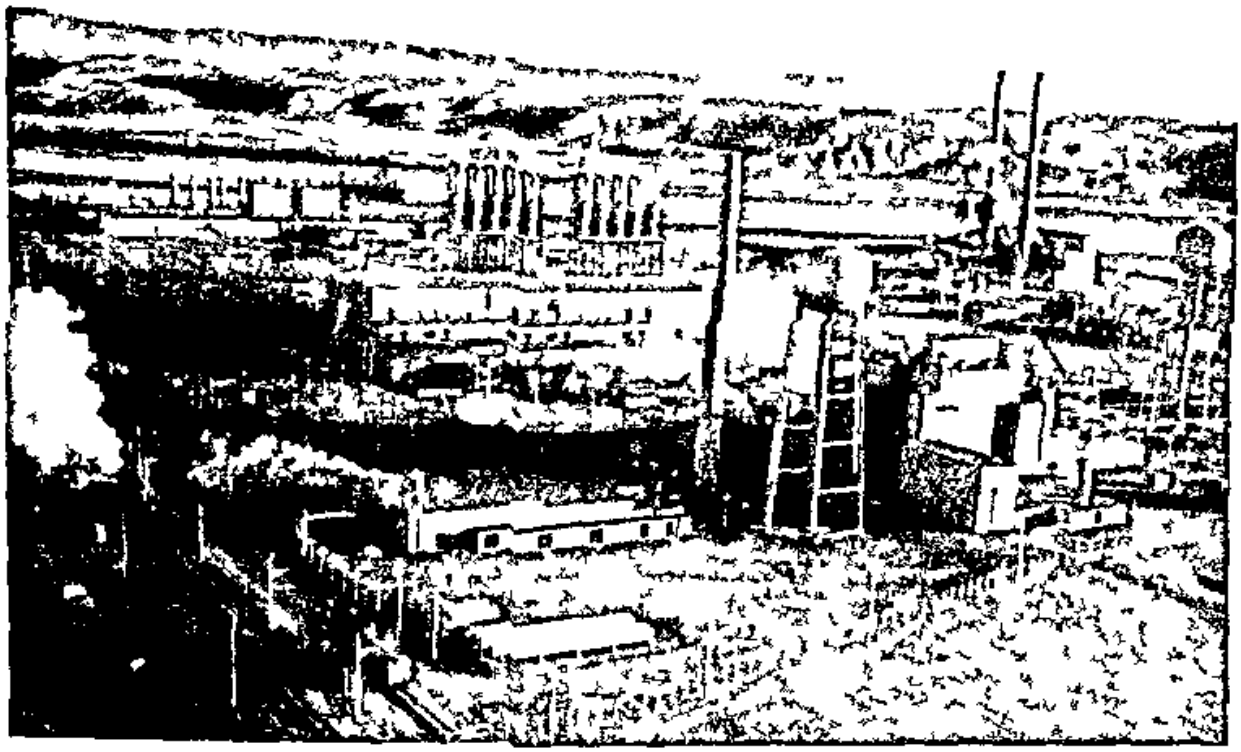
DURING the year that has passed physi cists were busier than ever They dis covered many new facts in nature and in vented a lot of new machines and devices and gadgets Most of them however have been working for the government on war research during the past few years and many of the things they have done are still secret They can tell very little as yet and it may be many years before we get the full story of all they did during the last year of the war

The greatest thing the scientists did—and perhaps we may even say that it was the greatest discovery ever made—was to find a way of using the energy of the atom s core in the atomic bomb Not because it was a *bomb* that is something to be used to blow up cities and kill people but because for the first time in the whole history of the world human beings have found the secret of what it is that keeps the sun and the stars shining

Before they could make the bomb they had to find out what goes on inside the atom and this took fifty years of study one generation of scientists handing to the next its dis coveries Not August 5 when the first bomb was dropped on Hiroshima but July 16 1945 will be a red letter day in the history of science That was the day when the first atomic bomb was set off at Los Alamos in the deserted mountain region of New Mexico There after years of hard work and many disappointments and discouragements that were almost heart breaking scientists knew they had succeeded at last They had opened up the tremendous store of power inside the tiny atom

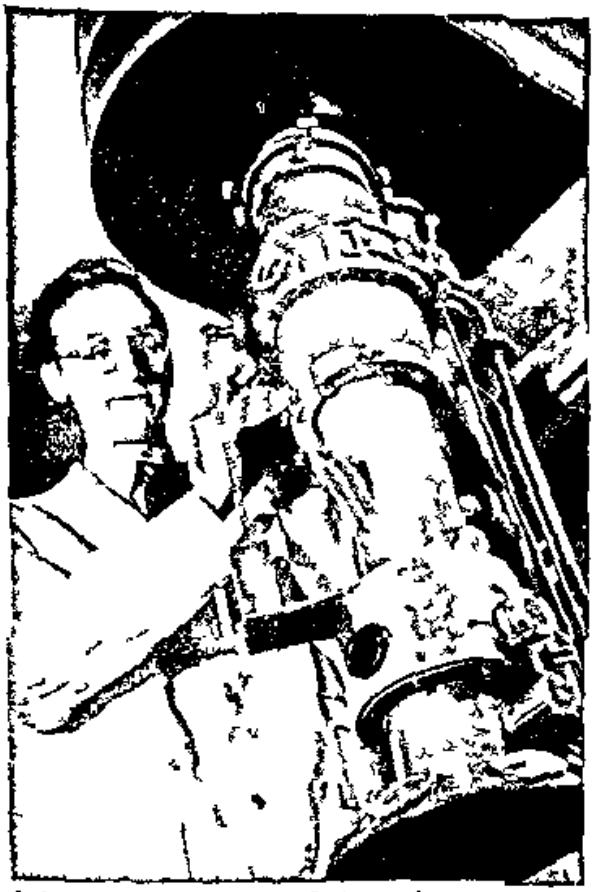
When the news came nearly all the world was unprepared for it, and most people sim ply could not believe it—except the children in America who had read the comic strips and knew all about Buck Rogers and Super man and Captain Marvel and the other mir acle men The children were really more fa miliar than most grownups with all these fantastic scientific affairs But this fantastic affair which is true and no make-believe, is the greatest marvel of all

The whole story of how it was done we may not yet tell Some of it you will find in the chapter on Atomic Energy, but a good deal of it is dangerous knowledge and the governments that share it have to keep the secret a little longer We know of course we can not keep it always for scientists the world over have been working on the same thing and soon others will be able to solve the problem too As a matter of fact scien tists do not believe in keep ng their dis coveries secret in peacetime They know per



Science Service photograph

Here at the Hanford Engineer Works Pasco Washington secret production work on the atomic bomb took place



A technician operates an electron microscope in the laboratories of the Hercules Powder Company

haps better than anyone else that if we all want to go forward we must all work together and must share the things we know and the new things we find out To the scientists our earth has been One World for a long time

Now that we know the secret of atomic energy and know at least how to use it to get an explosion the next thing to do is find out how to use it in everyday life—to fly our airplanes and drive our locomotives and perhaps even heat our homes and run our washing machines with it Perhaps some of you who read this chapter will help to solve the problem

We can mention at least one other triumph of physics Even though it did not all happen during the year, it was published during the year We mean RADAR It too played a very important part in the winning of the war, as far back as the Battle of Britain in the fall of 1940 At that time the English used it to tell them when and where the German planes were coming over So they were able to use their own few planes in the right place and to beat back the Germans

The idea of radar is really very simple it is like a blind man who walks around tapping

the ground with his cane when he comes close to a tree his cane will tell him where the tree is and he can step aside and not bump into it In radar we use instead of the cane a beam of invisible light When it hits an object it bounces back to us and we get the echo of it

The farther away an object is the longer it will take for the beam to come back Radar can be used by those on the ground as we have explained to scan the distant skies for approaching craft In peace or in war its beams can be sent out from ships to guide them through darkness and fog and into strange harbors During the war with Japan it directed the fire of guns against ships far out of sight It is also valuable to pilots

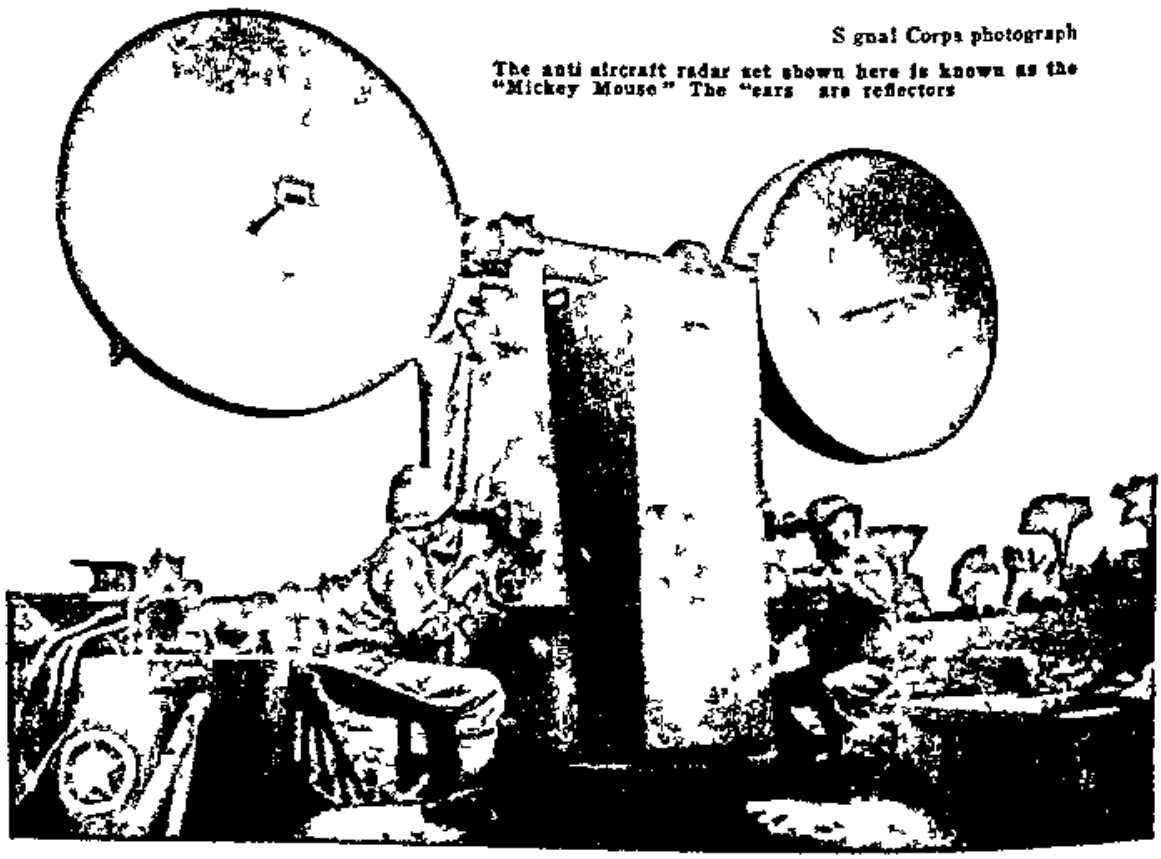
If a plane is flying in a cloud it sends out its beams in all directions and on the instruments as we now have them a luminous finger spins around on a screen When a beam hits something a light spot appears on the screen and the pilot gets a rough picture built up from these light dots of the object at a distance Even on a clear day the radar eye can see ten times farther than we can with ordinary light Exactly how it works you will have to look up in the article beginning on page 232

Radar can usually see through a cloud But when the clouds mass together and become very heavily laden with rain they too will bounce some of the radar beams back In this way the hurricane that struck Miami Florida in September 1945 was spotted on the radar screen and followed all along its course The Weather Bureau is already thinking of putting radar to use for weather predictions

There was one very special way in which radar was used in the war that we want to tell you about By mounting a radar sending set in the nose of a shell such a shell or bomb could be made to smell its target Before this when firing shells at airplanes for example either the shell had to be set to explode when it hit something or it carried a time-fuse which made it explode after so many minutes In the first case the shell would actually have to hit the plane If it missed by even an inch the plane would escape unhurt In the second case one would have to guess somewhat in setting the time of the fuse and hope that the enemy plane would be somewhere near when the bomb went off If there wasn t any plane near, the shell would go off just the same, but it would not do much harm

Signal Corps photograph

The anti aircraft radar set shown here is known as the "Mickey Mouse" The "ears" are reflectors





Brit sh Informat on Service

A Royal Air Force bomber is shown landing at a fog-covered airport with the aid of FIDO—Fog Invest gation Dispersal Operations. This British invention burns gasoline along both sides of the runway to dissolve the fog

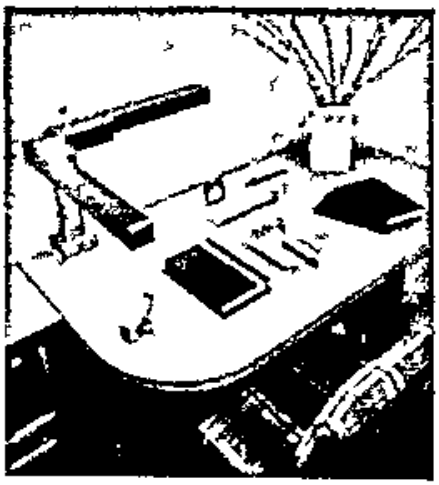
Now with the new built in radar set beams are sent out in all directions from the shell The time it takes for such a wave to go out get bounced and come back is recorded inside the shell by a little machine When this time of going and coming back is short enough then the object—a plane perhaps—is close enough to be damaged or destroyed by the explosion of the shell Before it is even fired the shell is set to explode for just that time and that distance Destruction of the target is thus made certain Some experts estimate that with such radar sets built into rockets or jet planes loaded with explosives such planes could be guided toward their target like homing pigeons They would ex plode at the right time without any human guides being in the planes at all In this way it might be possible to meet an enemy fleet of bombers a hundred miles away from their dest nation and explode the buzz bombs among them That would make it almost impossible for planes to get near big cities

We do not know in detail how the present atomic bombs were exploded But in the fu ture they, too could be exploded by using radar sets built into them

We want to mention one more contribu tion the physicists made to the war That is the fog-disperser—the British call it FIDO This is really not much more than a great b g heating unit that burns thousands of gallons of gasoline per hour and blows the vapor into the a r Fog-dispersers are used around airfields and when a dozen or so of them are lined up all around a landing strip it is possible in a short time to blow away, dissolve even the densest fog that may hang over the f eld Hot gases rise as you know In rising they must push up and aside the heavy dense foggy air This device was specially helpful when a large force of planes that had been out on a mission would come home and could not land because of the dense fog By the use of FIDO in England and in the Aleutians the lives of many pilots were saved

A few physicists have still been working on research that had nothing to do with the war especially on cosmic rays and what they really are They have been trying to find out more about that new and strange particle that we call the mesotron—what it is and where it comes from It seems that when the first cosmic rays—which are really protons that is small part cles that carry positive electricity—strike the upper layers of the air they produce mesotrons up there Sometimes these behave like fast electrons the very l ght particles that carry negative electricity Sometimes they behave more like protons themselves only they seem to be a little lighter

Other things the physicists have been working on are new ways of testing precious stones such as diamonds with X rays and ways to examine the surfaces of solid bodies with the electron microscope And of course a great deal more has been done in the line of splitting atoms of changing one chemical element into another and of trying to learn how the nuclei of these atoms that is the central cores way inside the atoms, are built up



A fluorescent desk lamp which throws a soft bright light, very much like daylight, upon the writing surface of the desk. Fluorescent lamps have long tubes of glass instead of the bulb-shaped incandescent lamps we have been used to

SCIENCE in the HOME



Sylvania Electric Products Inc.

A soft, restful effect in lighting is obtained by placing fluorescent lamps in continuous coves in the ceiling or in the walls above the windows. The lighting fixtures can thus be concealed giving plenty of light but no glare

By Samuel Baker

Dean, Schools of Technology, International Correspondence Schools

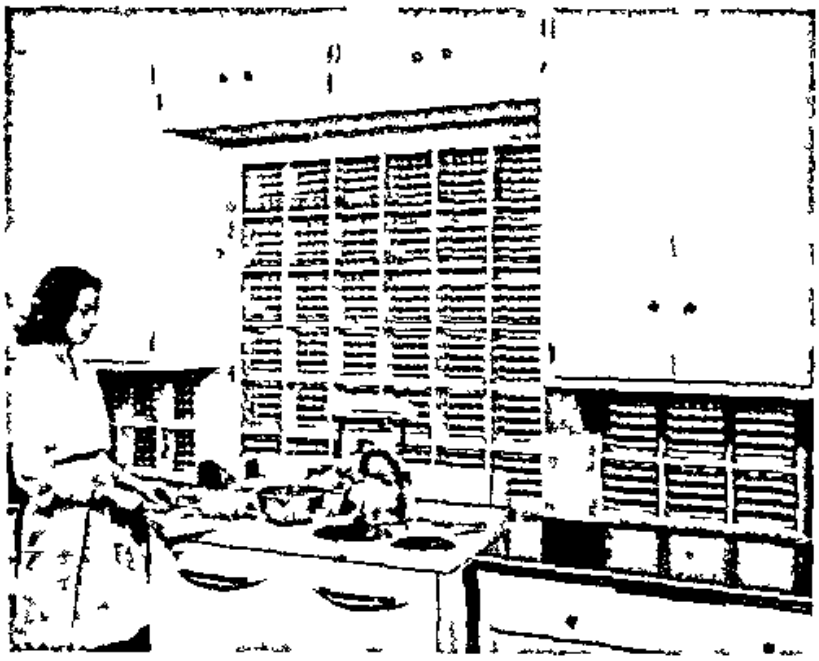
SCIENCE, the word comes from the Latin *scire*, to know The scientist strives to know exactly what everything in the universe is made of, and how He searches for the laws of nature by which all things are ruled, from the energy within the atom to the motions of the distant star-cities For thousands of years men have been adding to the sum total of human knowledge and this accumulation of knowledge has helped each generation to live a little more comfortably This is true, at least, in the part of the world where we live There are still places on the globe where science has made almost no headway In those places, life is simple, and hard There is little protection against disease homes are uncomfortable, and the forces of nature are feared

A motion picture of the onward march of civilization, or science, might be made around the changes in home construction Take one element—the arrangement for cooking our food Once an open fire in a cave sufficed, though it filled the cave with smoke Then came a hole in the roof to let the smoke through, next, a chimney to provide a draft But much of the heat, as well as smoke, went up the chimney, so stoves were invented The stoves burned wood, and they had to be refueled constantly Coal was found It burned longer, and more evenly, but it was dirty, ashes made a problem, and there was still an element of guesswork in cooking Your grandmother's recipes called for "a medium oven," or "a very hot oven" Modern cook books are made by scientific cooks All measurements are exact, including the degree of heat and the number of minutes at which the heat must be maintained Today stoves can be purchased that burn gas or use electricity, and have automatic heat controls and time controls. Some ring a bell to remind the housewife that now she must take her cake out of the oven Some turn the oven off at the right moment

Stoves of tomorrow will be even more advanced, for their designers will put to use even more of the findings of science Heat will not be wasted as it is today in top-of the-stove cooking Arrangements for fireless cooking, and for quick cooking by steam under pressure will be built into the stoves

The stove of tomorrow is only one piece of equipment in the kitchen of tomorrow, and the kitchen is but one room in the home of tomorrow Let us see what the architect has to say about the house that science will build for us to live in and enjoy

The new home is planned to meet the needs of our new ways of living Ever since the first World War, women have been entering lines of work that were formerly followed only by men This trend is expected to continue It means that in many families the wife as well as the husband will go out to work, not so much through necessity as through choice Where there are children in the home, the mother will need more and



Courtesy Owens Ill no s Glass Co

Glass will be used in many more ways in the houses of the future The glass walls surrounding the working space in this kitchen give more daylight for the housewife They are good looking themselves and easy to keep clean

more time to devote to her family Therefore the new home must be easy to run

Advances in technology will continue to shorten the hours of labor so that adults will have more time for hobbies and outdoor recreation The architect is aware of this He knows, too, that improvements in transportation are making it possible for more people to live farther away from the crowded cities The planning for the new homes therefore, gives more attention to spaces for recreation and for living outdoors

The average home of tomorrow will be a low, rambling building without cellar or attic The scientific advances which make it possible to build this kind of house are the result of long research and experimentation in types of building material in methods of heating and air conditioning and in the development of electrical equipment

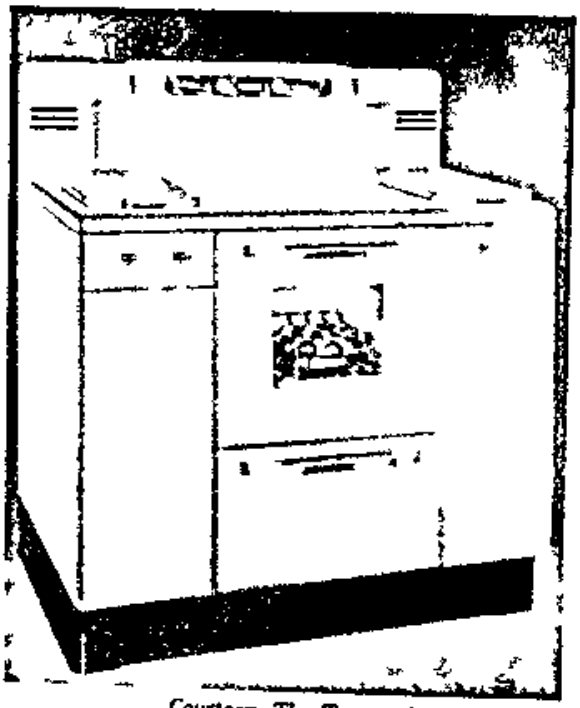
The heating and air-conditioning equipment will be in a room on the ground level rather than in a cellar The kitchen will be an efficient little factory, equipped with labor saving devices mostly electrical, for cooking dishwashing and laundering

In many homes there will be no separate dining room, but dining space will be provided in the part of the living room nearest the kitchen The bedrooms will usually be on the ground floor, in a separate wing of the house If there is a guest room, it will serve



Courtesy Libby Owens Ford Glass Co

The glass wall which brings the outdoors into the living room is made of a special insulating glass made of two or more panes with a sealed in dehydrated air space between them It lets in the sunshine but not the cold air



Courtesy The Tappan Stove Company

A gleaming white gas stove which has automatic heat control, a lighted oven with a window through which you can see the food cooking and other helps.

also as den for unused space will be avoided There will be plenty of bathrooms plenty of closets and built in dressers and other furniture Overcrowded fussy rooms will be avoided

Some of these new houses give the impression that they are all windows This too is something which scientific progress has made possible You know that light passes readily through glass but heat does not pass so readily A glass has been developed through which heat passes at a very slow rate so that large areas of window space are no longer a hindrance in heating the house in winter and keeping it cool in summer So far as the general plan of the house is concerned this means that the outdoors can help to beautify the indoors with the use of picture windows or whole walls of glass looking out upon a lawn or a garden

Some of the new important developments in materials used for home building are the work of the chemists These scientists have learned how to impregnate (soak) lumber with chemicals that increase its strength its durability and its resistance to fire They have also made paints that are waterproof and resist fire

The use of plywood as a building material or for production of furniture has been greatly expanded by discoveries in the new field of plastics Plywood is made by gluing together several thin layers of wood with the grain in each layer at right angles to the grain in the adjoining layers This makes tough wooden sheets for use in walls and ceilings When such sheets are impregnated with a transparent plastic, plywood panels show clearly the natural beauty of the wood.

To increase safety in moving about the house at night luminescent or phosphorescent plastics will be used for switch plates lamp shades and bases telephone receivers and stairway risers and railings

More use will be made of metals especially aluminum magnesium and stainless steel for window sashes and other structural and decorative purposes

By applying the principles of physics and chemistry new methods of heating and air conditioning have been developed which make houses both healthier and more comfortable The new heating system will be easier to operate than those to which we have been accustomed In the new system known as radiant heating hot water or steam is sent from an automatically fired heater or boiler through coils of pipes embedded in the floor and sometimes also in the ceiling and the walls If a hot air unit is used the hot air is sent through ducts in the floor Thus with radiant heating there are no radiators or registers In hot weather, the house would be cooled by pumping chilled water through the radiant coils of a hot water system, or cold air through the ducts of a hot air system



Electrical Merchandising Magazine

Washing dishes can almost be fun when your kitchen has an electric dishwasher like this.



Courtesy Deep Freeze Motor Products Corporation

In such deep-freezing units as this, people will be able to store fresh foods, including meat, milk and vegetables preserving all their freshness.

The term *air conditioning* has come to mean more than merely cooling the house in summer It now means also adding moisture to the air and heating it in winter removing excess moisture and cooling in summer and year round filtering and cleaning of the air Some of the filtering methods depend upon new uses of electricity

Advances in lighting have made the old massive ceiling fixtures with their glaring lights seem entirely out of date Scientists, experimenting with electricity and its effects on metals and gases under various conditions have developed fluorescent lamps which create the color of daylight Fluorescent lights have little glare and give off much less heat than is given off by the familiar incandescent bulbs The fluorescent lamp may be the chief means for lighting the home of tomorrow A soft luminous effect for general lighting is furnished by using continuous coves in the ceiling or in the walls above the windows with hidden fluorescent lamps in the coves Where stronger light is needed direct "downlight" is built in—for example, over the reading chair or the dressing table or the kitchen stove

More attention is being given to arranging the lighting so that it will blend quietly with the decorative scheme of the house Floor lamps without cords are promised The current will depend on vacuum tubes

A radio-television receiver equipped to receive sound and visual programs, will be mounted in a place specially designed for it in the home of tomorrow It will have facilities for inscribing sound programs on disc or wire records and for playing them when desired

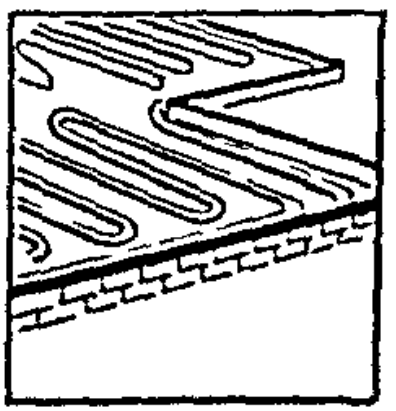
Radio programs will come into the home with greater realism As a result of the further development of frequency modulation or FM, sound in its full range and brilliance will flood the atmosphere and no discordant crashes of natural or man made static will mar the performance Television in full color is promised The home town parade or the football contest a fashion show or dance lesson a popular quiz program or an opera will be seen as well as heard

Phonograph records will be unbreakable They may be in the form of plastic discs (some of which we now have) or wire Or they may be steel tapes in which the sound pattern is written magnetically

The radio will never rest When the family is about to retire a flip of a switch will turn the radio into a facsimile recorder which will silently grind away all through the night and in the morning will supply a printed copy of the latest news Anything that can be put on paper—printed matter writing photographs and cartoons—will be reproduced on the facsimile recorder of the home This will by no means take the place of our full sized daily paper but will probably serve to make the full sized paper more carefully read

Most of the labor saving devices and many of the mechanisms that are now operated by hand will be more effectively controlled by electronics in the home of tomorrow Doors in the home and in the garage will open or close automatically on the approach of a person Many of the arduous or distasteful tasks in the home will disappear when the facts known to science today are put to general use in the home of tomorrow

Courtesy Small Homes Guide



In the new system called radiant heating, pipes placed between the floor of one room and the ceiling of the room below give an even temperature to both rooms with no hot or cold air currents. The floors and walls are pleasantly warm, and yet the air in the room does not become overheated

SCIENTISTS of the GOLDEN AGE

By **Thomas Gordon Lawrence**



U S Navy photo

Albert Einstein who has charted new paths in science

THE Golden Age of Science is right now Since 1900 discoveries have come so thick and fast that we have room here only to mention some of the most interesting and important ones

In the Middle Ages every alchemist hoped that he would be the fortunate discoverer of the philosopher s stone that wonderful something which was believed to have the power to change base metals such as lead or iron into precious gold As the philosopher s stone did not exist, it remained undiscovered The quest was given up as hopeless

About a hundred and forty years ago, John Dalton decided that the atom was the tiniest particle of matter that could exist and that the atoms of the different elements were essentially different How could one atom be changed into another? Impossible! But twentieth-century physicists have done the impossible They have changed one element into another!

The story of the modern version of the philosopher's stone begins in the middle of the nineteenth century with the discovery that when an electric current is passed through a vacuum tube strange rays occur in the tube We call them cathode rays Cathode rays were shown by Sir Joseph J Thomson (1856 1940) of Cambridge University, England to be streams of particles about $\frac{1}{1800}$ as heavy as a hydrogen atom We call these particles electrons, and electrons we now know are bits of energized matter in atoms Thomson found that all electrons are identically the same no matter from what type of atom they come So now we have something smaller than the atom and this something is the same in all atoms

Before his death Thomson saw other men go on to do what had been believed for centuries to be impossible—change one atom into another One of these men was Thomson s own student at Cambridge a young New Zealander Ernest Rutherford (1871 1937) Rutherford became professor of physics at McGill University in Montreal Canada In 1900 he found that the element thorium gave off a gas of its own accord This meant that thorium was breaking up spontaneously But what was the gas and what was left behind? Frederick Soddy (1877) a young chemist from Oxford University helped to solve the riddle Rutherford and Soddy then went to work on radium which is far more active than thorium In 1900 they announced that as radium broke up it gave off three different kinds of rays (1) positively charged alpha particles (2) negatively charged beta particles (electrons) (3) gamma rays which did not consist of particles at all but were similar to light waves only much shorter (Alpha beta and gamma are the first three letters of the Greek alphabet The names were given to the particles and rays for a quick way of tagging them)

In England in 1907, Rutherford allowed alpha particles to enter a glass chamber from which the particles could not escape Examining the chamber later he found no alpha particles but he found helium gas The explanation was that the alpha particles were really the same thing as the nuclei of helium atoms—two protons and two neutrons These positively charged nuclei attracted negatively charged electrons from the glass walls of the chamber and thus became helium atoms This bore out Thomson s theory

that every atom consists of a nucleus having a positive charge and surrounded by negatively charged electrons

Rutherford reasoned—if all atoms consist of electrons surrounding a nucleus, could he change one atom into another by changing the nucleus? He knew that this takes place in nature in radioactive elements Could he make this happen to other elements? He needed a bullet that could be shot into the nucleus of an atom But where was there a bullet small enough and powerful enough? The answer was—the tiny alpha particles themselves, which travel at a speed of more than 10,000 miles a second

In 1919 Rutherford bombarded nitrogen gas with alpha particles from radium rays Some of the nitrogen atoms changed to oxygen! True, in 49,999 cases out of 50 000 the alpha particles sailed right through the nitrogen atoms without disturbing them But in one case out of 50,000, the alpha particle crashed "just right" into the nitrogen nucleus and stayed there, at the same time knocking a proton from it Thus the nucleus gained two protons and lost one, making a total gain of one, and changing its atomic number from 7 (nitrogen's number) to 8 (oxygen's number), but changing its atomic weight from 14 to 17 (The alpha particle contains two neutrons, remember, and a neutron has about the same weight as a proton)

THE ALCHEMISTS' DREAM—CHANGING ONE ELEMENT TO ANOTHER—COMES TRUE

So, with Rutherford's wonderful experiment nitrogen had been changed to heavy oxygen! One element had been changed to another! What the alchemists had dreamed, Rutherford had accomplished! We have come to think of this operation as "smashing the atom"

In 1925 the process was actually photographed by a device called the cloud-chamber In 1910, another Cambridge physicist, C. T. R Wilson, had devised this chamber for the purpose of photographing the paths of ultramicroscopic charged particles, particles too small to be seen under the microscope This is the way it helped Sudden expansion of moist air which filled the chamber caused the temperature to drop and water vapor condensed about any charged particles which happened to be in the chamber The path of these particles could now be photographed, though not, of course, the particles themselves By the time of Rutherford's death in 1937, several atom smashing weapons were available for physicists.

Robert Andrews Millikan (1868), the son of an Illinois preacher, achieved fame by isolating and measuring the electron For this work he received the Nobel Prize in physics in 1923

THE STRANGE RAYS THAT BOMBARD OUR EARTH FROM DISTANT SPACE

Now Millikan began to investigate certain mysterious rays of which physicists had begun to take note around 1900 Rutherford had found them annoying because of their ability to penetrate thick screens of lead and otherwise upset perfectly planned experiments Did these rays originate on earth? Millikan sent pilot balloons carrying instruments as high as ten miles, reaching into the stratosphere The mysterious rays were stronger the farther from earth the balloon rose They finally were seven or eight times as strong as on earth Definitely the rays did not originate on the earth In addition the rays were shown to be equally strong day or night Evidently the rays did not come from the sun either Were they cosmic in origin? That is did they come from the vast spaces among the stars?

Millikan traveled to the far reaches of the earth to measure these cosmic rays Everywhere he found cosmic rays at the tops of mountains, in valleys, deep below the surface of lakes

Another American scientist Arthur Holly Compton (1892-), came to believe that cosmic rays were really charged particles traveling at terrific speeds

Following the work of J J Thomson and others, it was agreed that the atom, instead of being a tiny solid mass is really mostly space, with a comparatively heavy nucleus in the center and with electrons revolving about the nucleus The nucleus contains one or more structures called protons, each of which has a positive electric charge and weighs almost 1 850 times as much as an electron Each electron has a negative electric charge Further details on the structure of the atom are given on page 48

The idea that electrons spin around the nucleus was worked out by the Dane, Niels Bohr (1885-). Two American scientists Irving Langmuir (1881-) and Gilbert N Lewis (1875-), continued the study of the structure of the atom

You remember that Mendeleef classified the chemical elements according to their weights. A twenty six year-old Englishman Henry G J Moseley (1887-1915), made a better arrangement—a table of elements ac-



Both pictures Science Service

Thomas Hunt Morgan Sir Ernest Rutherford

cording to atomic number (Atomic number is the number of electrons in the atom—which is of course equal to the number of protons in its nucleus) Moseley was killed at Gallipoli in World War I

What is matter? Before the time of Dalton most people thought that a piece of iron was solid all the way through The atomic theory indicated that all matter is composed of particles called atoms and that there are spaces between the atoms J J Thomson Rutherford Bohr and the rest showed that the atom itself is mostly space But what are the electrons and the protons and the other bits within the atom? Are they tiny hard solid bodies? The French scientist Louis Victor Prince de Broglie (1892) suggested in 1924 that the electron itself must be thought of not only as being a tiny particle but also as consisting of a group of waves similar to the waves of light! The Austrian Erwin Schroedinger (1888) and the German Werner Heisenberg (1901), have developed ideas like those of De Broglie

In 1913 F W Aston (one of J J Thomson's many brilliant pupils) discovered that in some elements not all of the atoms have the same weight Atoms which do not follow the general rule are called *isotopes* Aston discovered an isotope of the element neon About 300 isotopes have been found since, including 11 for tin Uranium has several isotopes The famous one is uranium 235 Ordinary uranium has weight 238

Another famous isotope heavy hydrogen was discovered by Harold C Urey (1893) at Columbia University in 1932 The atom of heavy hydrogen has an atomic weight of 2 twice that of ordinary hydrogen Water in whose molecules heavy hydrogen takes the place of ordinary hydrogen is called heavy water The heavy hydrogen is called deuterium

Discovery of heavy hydrogen opened up a new field of research If heavy hydrogen is substituted for ordinary hydrogen in fats and the fats are fed to animals, we can later find out what happened to the fats in the animal's body by following the course of the heavy hydrogen molecules Heavy hydrogen can be called a tracer element because we can trace its course through the animal's tissues Radioactive tracer elements sodium and phosphorus have been used by John H Lawrence (brother of Ernest Orlando Lawrence) and Herbert M Evans (1882) to find what the body does with chemical substances

In 1934 Irene and Frédéric Joliot Curie produced the first artificially made radioactive substances including radioactive aluminum and nitrogen Thus the Curie family continued to pioneer in the work in radioactivity for Irene is the daughter of Marie and Pierre Curie

Rutherford's work had opened the question of atomic power The force which holds atoms together is tremendous If only a portion of this energy could be released for use scientists figured we would no longer worry about using up all our coal and oil supplies, for in atoms we have an inexhaustible supply of power Madame Curie had noticed that as radium broke up energy was released Rutherford and his co workers had noticed that when they hit an atomic nucleus with an alpha particle energy was released in large quantities

LAWRENCE BUILDS A BIG MACHINE FOR SMASHING LITTLE ATOMS

Ernest Orlando Lawrence an American physicist (1901) used a 60-ton magnet to which he added another 25 tons of equipment to build an 85 ton machine called a cyclotron for smashing atoms In 1934 this cyclotron changed platinum to iridium and gold When iron was bombarded some of it changed to cobalt and manganese while some became radioactive Some thirty four different elements were subjected to the action of the cyclotron, and all were changed to something else

But more than that uncharged particles called neutrons were knocked out of the nuclei A neutron is about as heavy as a proton—it is said that a thimble packed with neutrons would weigh a million tons—and since a neutron has no electric charge it makes a better bullet than an alpha particle Why? Because the electric charge of the alpha particle sometimes proves a nuisance

The neutron carries no charge (An alpha particle, being positively charged meets some resistance from nuclei)

For his work with this 85 ton cyclotron Dr Lawrence was awarded the Nobel Prize in physics in 1939 By 1940 he had built a 225 ton cyclotron at the University of California

Another type of atom smasher is the Van de Graaff generator developed by Robert Van de Graaff of Alabama (1901) Both the cyclotron and the Van de Graaff generator although they work in different ways are designed to accelerate subatomic particles to great speeds for bombarding atoms

Before World War II started in 1939 it was known that if a heavy atom like that of uranium could be completely broken up enormous amounts of energy would be liberated. If the atom was even split in two (thus forming two new atoms of lighter chemical elements) the amount of energy released would still be fantastically great although only a fraction of what would result from the complete destruction of the atom

Now when energy is suddenly liberated anything that stands in its way is pushed aside with such violence that we have an explosion Some explosions are useful as when we use them to run a gasoline engine Other explosions are violently destructive as when the top of a volcano blows off or a B 29 drops its bomb load

THE RACE TO DEVELOP THE WORLD'S MOST TERRIBLE WEAPON

There was a fearful race between nazi scientists and those of Great Britain Canada and the United States to develop the atomic bomb which gets its titanic power from the smashing of atoms There is poetic justice in the fact that among the most important scientists on the Allied side were distinguished exiles driven out of Germany and Italy by the Nazis and Fascists

Up to 1939 more work had to be done to smash an atom that was released in the form of energy when the atom was smashed But in 1939 German physicists including Otto Hahn (1879) fired neutrons at uranium atoms and scored a bull's eye At first the scientists were not entirely sure of what their results meant but they noticed that the element barium had appeared (which was not present before) and that enormous quantities of energy had been released The energy production was on a scale far above



Science Service

Arthur H Compton noted for studies of cosmic rays and Irving Langmuir authority on the structure of atoms They had a part in developing the atomic bomb

anything noted before in atom smashing Lise Meitner (1878) and R O Frisch (1904), both soon to flee from Germany because of their Jewish ancestry found the explanation The uranium atom had split into two new atoms one of barium and one of the rare gas krypton More important was the fact that while the neutron that hit the uranium atom had one thirtieth of a volt of energy the uranium atom shot out 200 000 000 volts—six billion times as much energy as was put into it

Fortunately for civilization two of Europe's greatest experts Enrico Fermi who had been exiled by Mussolini and Niels Bohr of Denmark who escaped during nazi occupation were working at Columbia University Dr Frisch sent the news of the breaking up of uranium to his father in law Bohr

As the life-and-death struggle in Europe got under way President Roosevelt saw to it that American and British efforts were pooled Many of the greatest scientists in both countries were involved in the work

It was Fermi's idea that when the uranium (or other) atom was struck by a neutron and split other neutrons would fly out from the broken nucleus Now if these would hit still further atoms and split them a chain reaction would take place and the final explosion would be on a gigantic scale It was found that ordinary uranium (weight 238) was not suitable but that the rarer uranium 235 was. Before the work was completed two elements never found in nature had been made neptunium and plutonium both heavier than uranium 238 Apparently most of the explosive material in the atomic bombs dropped on Japan was plutonium We tell

you more about the atomic bomb in the story of atomic energy, page 53

So far there is no immediate prospect for any practical use of atomic power except in warfare It has been said that if all the protons and electrons in one drop of water were to destroy each other, enough energy would be evolved to supply 2,400 horse power for a month When atomic power is finally tamed for peaceful use, we may expect a revolution in industry as great as that produced by steam and electricity

During the latter part of the nineteenth century scientists worked out the strange events which take place when the nucleus of the cell divides—the strange dances of the chromosomes called mitosis and reduction division *With this knowledge biologists* were ready to carry on the work of Mendel when it was re-discovered in 1900 The English biologist William Bateson (1861 1926) and his pupils showed that inheritance of the type described by Mendel takes place in mammals, birds and insects W L Johannsen (1857 1927), the Danish physiologist, showed that selection alone would not produce a new type of organism

EXPERIMENTS ON THE TINY FRUIT FLY PROVE NEW IDEAS ABOUT HEREDITY

William E Castle (1867-), of Harvard University, found the ideal creature for experiments in heredity, the fruit fly sometimes called the vinegar fly The fruit fly grows from egg to adult fly in ten days, lives in perfect health in the laboratory, and has only four pairs of chromosomes Every laboratory in the world where heredity is studied now has its rows of pint milk bottles housing hundreds of thousands of fruit flies

Thomas Hunt Morgan, famous as the founder of the gene theory, was born in Lexington Kentucky, in 1866 the year Mendel published his results In 1909 Morgan studied thousands of fruit flies to see if any of them would show the mutations De Vries had written about In 1910 a mutant white-eyed male fly suddenly appeared in a family of normal red-eyed flies In the same year Morgan found that his flies produced fifteen *mutations, that is, fifteen new types* different from any of their ancestors Soon Morgan gathered a group of devoted students in his laboratories at Columbia University

One of these students, Hermann J Muller (1890), produced artificial mutations in fruit flies by bombarding the parent flies with X rays Soon after two other American scientists, L J Stadler and T H Goodspeed, artificially produced mutations in plants *Man now was not only able to change* one chemical element into another, he could also produce new types of organisms in one generation

Back in 1901 the American scientist C E McClung (1870-) had argued that the sex of grasshoppers was determined by certain small chromosomes Morgan's students one of whom was his wife, Lillian V Morgan, produced abundant evidence to bear out this theory Mrs Morgan helped explain the inheritance of sex linked traits (the fact that women are rarely bald, for example, and the strange cases where a normal mother can transmit hemophilia, the bleeder s disease, to her sons, but not to her daughters)

Albert F Blakeslee (1874) of the Carnegie Institution, found that sometimes the chromosomes would fail to divide in a plant, with the result that new types were produced with double the ordinary number of chromosomes The new plants with the extra number of chromosomes turned out to be very different in many cases from their parents Soon it was found that by applying colchicine, a poisonous juice extracted from the autumn crocus, these chromosome doublings could be produced artificially Hence new types of plants could be grown (Of course, the scientist doesn t know in advance what the new type will be)

Thanks to Morgan and his students, *including Alfred H Sturtevant (1891-)*, Calvin B Bridges (1889 1938) and T S Painter (1889), we now have "maps" of the tiny chromosomes of the fruit fly These maps show the exact location of those mysterious structures along the chromosomes which are called genes, and which determine hereditary characteristics, such as eye color, whether a fly will have wings or not, and other traits

AN ECLIPSE OF THE SUN TESTS THE THEORY OF RELATIVITY

On May 29, 1919, parties of scientists were gathered in Africa and Brazil, at opposite sides of the world Tension was high All the apparatus was ready—the telescopes, the cameras, the spectroscopes *Now everything* depended on the weather Would it be clear? Or would clouds obscure the total eclipse of the sun for which they were waiting?

At the same time Albert Einstein sat quietly at home in Berlin He had every reason to be nervous, for these scientific expeditions were going to test his theory If the eclipse was not obscured by clouds, pho-

tographs would be taken which would show once and for all whether Einstein was correct in stating that light rays bend as they pass close to a bulk like the sun The photographs were taken and Einstein was shown to be correct He had started a revolution in the world of physics

Albert Einstein was born at Ulm Germany, May 14 1879 In 1894 Albert went to Zurich, Switzerland where he supported himself by teaching physics and mathematics while he studied at the university He was a rather lonely man and shy He became a Swiss citizen and took a position as patent examiner in Berne He continued his studies at the University of Zurich and got his degree as a Doctor of Philosophy

In 1905 Einstein published his Special Theory of Relativity This took the scientific world by storm and his reputation was assured In 1913 Berlin created a position for him—director of the Kaiser Wilhelm Physical Institute and he was elected to the Royal Prussian Academy of Sciences

In 1915 he published his General Theory of Relativity When his theory was tested by scientists all over the world many honors came to him, including the Nobel Prize in physics in 1921 Einstein's studies continued He was trying to find a way to explain the basic facts of our universe—space time and motion—in exact mathematical figures a thing no scientist had ever been able to do For years few minds were able to grasp his problems or to follow his thinking very closely and even today it takes a student of advanced physics to have a clear understanding of his theories

NEW DOORS TO KNOWLEDGE ARE OPENED BY ALBERT EINSTEIN

Einstein and others have shown that Isaac Newton's Law of Gravitation has certain tiny defects when applied to matter in outer space These modern scientists have made suggestions for changes in Newton's physics The really great thing Einstein has done has been to keep scientists aware of the magnitude of their subject "We are just at the open doorway of knowledge he seems to say Let us not be afraid to enter the wonderful house and explore its many rooms"

In the days when the Nazis ruled Germany, Albert Einstein was driven from the country and stripped of all his belongings He made his way to the United States, and from 1933 to 1945 he taught mathematics at Princeton University He became a naturalized citizen of the United States.



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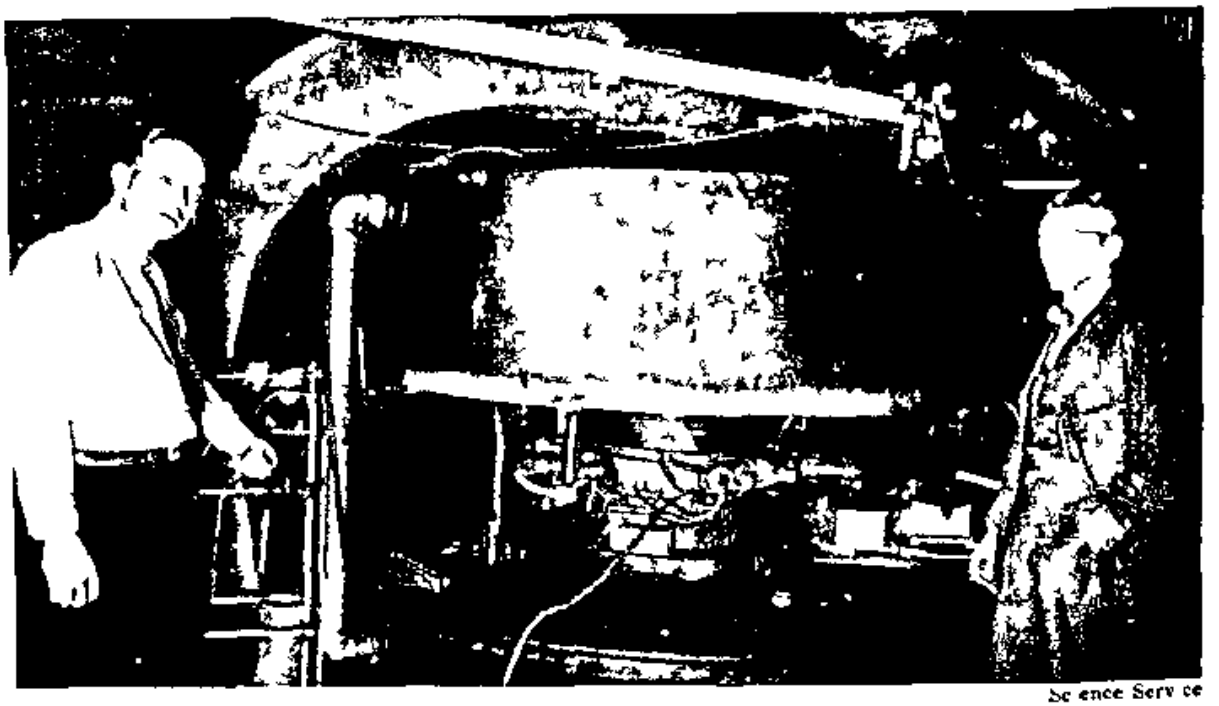
In their Paris laboratory Irene Curie and her husband Jean Frédéric Joliot continue the great work of Marie and Pierre Curie on radioactivity

One of the most fascinating developments in recent science has been the study of hormones those secretions produced by glands which make people grow tall or short fat or thin active or inactive By means of thyroid extract the type of idiot called cretin has been made mentally normal while other hormones have been used actually to change the sex of animals—hens into roosters for example

More and more we are probing into the secrets of the living cell On January 17 1912, Dr Alexis Carrel (1873 1944) a French scientist who had come to the United States opened a hen's egg and cut out a tiny fragment of tissue from the heart of the developing chicken Today that piece of heart tissue is still alive and in the best of health It grows so fast that half of it is cut off and thrown away twice a week Other biologists have discovered how to graft parts of various lower animals, so that they can take the leg of one species of young salamander and graft it in place of an amputated leg

Almost every day the newspapers carry accounts of new discoveries in the field of drugs and vitamins A wonderful discovery was penicillin the drug developed from a mold which checks the growth of harmful bacteria It has been discovered that many plants (including the buttercup the pine tree and many fungi) produce antiseptics which render a similar service

In the field of chemistry, new materials



Science Service

The 85-ton cyclotron (or "atom smasher") with its creator Ernest Orlando Lawrence on the left.

such as new plastics rubber like materials synthetic precious stones and new metal alloys are announced frequently Among the most marvelous of the recent inventions is the electron microscope which focuses streams of electrons instead of light waves and enables us to make pictures of objects one-fiftieth the size of the smallest thing visible with the best light microscope

We must remember that the findings of science can be used for man s destruction as well as for his benefit Due to science men no longer die like flies in great epidemics of plague and yellow fever and they need not suffer from many ills which were common only yesterday But science also makes it easier for men to kill each other and to wreck cities and whole countries with a speed undreamed of until recently

Science has not been able to make living things from non living matter

The great questions as to the ultimate nature of matter and energy remain questions and it is here that the language of the specialist is probably most difficult for the student to understand When we get to the smallest particles of matter the electron and the proton we find it hard to say just what they are They have what the physicist calls mass and they have electric charges Another fundamental particle the neutron has mass but no electric charge We used to believe that matter was very definitely one thing and energy something else—yet now we find the distinction between matter and energy breaking down

In living bodies it has been found that many (perhaps all) life processes are closely tied up with electric charges All nerve action involves electricity Hence the doctor can tell an epileptic from a normal person by differences in the electrical waves of the brain Absorption of materials through living cell membranes seems to have some electrical basis

In chemistry it has been found that matter is electrical in nature The electrical nature of atoms accounts for their ability to combine into molecules Atoms of one element have been transmuted into atoms of different kinds merely by adding or subtracting electrically charged particles in the nucleus as we have seen

Radio waves, light rays ultraviolet rays X rays, gamma rays are all electromagnetic disturbances differing from each other only in wave-length and frequency of oscillation

All this seems to support a oneness about the universe a unity in the natural laws under which the universe operates Albert Einstein expressed this idea in 1905 when he suggested that matter is simply concentrated energy and that energy can be converted into matter and matter into energy

For every discovery and every problem solved new problems loom up Perhaps this is just as well There will always be work for the young scientist to do

OUTSTANDING 20TH-CENTURY SCIENTISTS

Sir Joseph J Thomson (1856 1940) English Discovered the nature of cathode rays Made important contributions to electron theory

Max Planck (1858) German Proposed quantum theory of energy Won Nobel Prize in *physics 1918*

Sir William Henry Bragg (1862) and his *son William Lawrence Bragg (1890-)* English Investigated the arrangement of atoms in crystals Joint winners of Nobel Prize in physics 1915

George Washington Carver (1864 1942) American biochemist

Thomas Hunt Morgan (1866 1945) American Founder of the gene theory of heredity Won Nobel Prize in medicine 1933

Theodore William Richards (1868 1928) American Determined the atomic weights of chemical elements with great accuracy Won Nobel Prize in chemistry 1914

Robert Andrews Millikan (1868) American Measured charge on the electron Worked *with cosmic rays Won Nobel Prize in physics* 1923

C. T. R. Wilson (1869-) *Scottish Invented* cloud chamber which makes it possible to photograph the trail of *an electron or other* sub atomic particle Won Nobel Prize in physics 1927

Ernest Rutherford (1871 1937) New Zealander Important experiments on nucleus of atom Changed one element into another Won Nobel Prize in chemistry 1908

Walter B Cannon (1871) American Studied work of glands and relation between emotions and vital functions

Alexis Carrel (1873 1944) French Kept chicken heart tissue alive for many years Won Nobel *Prize in medicine* 1912

William D Harkins (1873) American Predicted *the discovery of the neutron*

Albert F Blakeslee (1874) American Experimented on heredity in plants

Charles William Beebe (1877) American Explored undersea life in bathysphere Authority on birds

Frederick Soddy (1877) English With Rutherford discovered three different kinds of rays given off by radium Won Nobel Prize in *chemistry* 1921

Lise Meitner (1878) born in Germany Co operated *in splitting uranium*

Albert Einstein (1879) born in Germany now an American citizen His theories have caused a revision of fundamental ideas about the universe Won Nobel Prize in physics 1921

Otto Hahn (1879) born in Germany Discovered (1918 with Lise Meitner) radioactive element protoactinium Won Nobel Prize in chemistry 1944

Clinton J Davisson (1881) American Known for researches in electricity magnetism and radiant *energy discovered (with L H Germer)* the diffraction of electrons by crystals (1927) Shared Nobel Prize in physics 1937

Sir Alexander Fleming (1881) English Discovered penicillin in 1928 Shared Nobel Prize in physiology and medicine 1945

Irving Langmuir (1881) American Helped *to develop the electron theory* Won Nobel Prize in chemistry 1932

Herbert McLean Evans (1882) American Important work with hormones and vitamins

Roy Chapman Andrews (1884) American *Discovered dinosaurs eggs and other fossils*

Niels Bohr (1885) Danish Worked out a *theory of atomic structure Won Nobel Prize in* physics 1922

Henry G J Moseley (1887 1915) *English* Established table of atomic numbers of elements from the action of X rays

Erwin Schroedinger (1888) Austrian Developed the idea that matter may be thought of as consisting of waves Won Nobel Prize in physics 1933

Hermann J Muller (1890) American Produced artificial mutations in fruit flies

James Chadwick (1891) English Discovered the neutron Won the Nobel Prize in physics 1935

Prince Louis Victor de Broglie (1892) French First to state that the electron may consist of waves Won Nobel *Prize in physics 1929*

Arthur H Compton (1892) American *Worked with cosmic rays Studied effects of* X rays on electrons Won Nobel Prize in physics *1927*

George P Thomson (1892) English Son of Joseph J Thomson Produced evidence to show that electrons behave like waves Shared Nobel Prize in physics 1937

Harold Urey (1893) American Investigated heavy hydrogen and heavy water Winner of Nobel Prize in chemistry 1934

Artturi I Virtanen (1895) Finnish Won Nobel Prize in chemistry 1945

Sir Howard W Florey (1898) English Study of penicillin in 1939 Shared Nobel Prize in physiology and medicine 1945

Isador I Rabi (1898) American Made an estimate of the diameter of the neutron Won *Nobel Prize in physics 1944*

Jean Frédéric Joliot (1900) and **Irene** *Curie (1897) French Artificially produced* radioactive elements Joint winners of Nobel *Prize in chemistry* 1935

Wolfgang Pauli (1900) born in Austria Won Nobel Prize in physics 1945

Werner Heisenberg (1901) German Discovered the principle of uncertainty" This means that science can not know both the exact velocity and the exact position of an electron at the same time Won Nobel Prize in physics 1932

Ernest O Lawrence (1901) American Developed the cyclotron the atom smasher Winner of Nobel Prize in physics 1939

Enrico Fermi (1901) *Italian Important* work in development of atomic bomb

Wendell M Stanley (1904) *American Discovered* that certain disease-causing viruses are *actually crystalline proteins*

J Robert Oppenheimer (1904) American Directed atomic bomb research in New Mexico

Carl D Anderson (1905) American Discovered the positron (or positive electron) a particle of the same mass as the electron but with a positive electric charge. Won Nobel Prize in physics 1936

Ernst Boris Chain (1906-) born in Germany *Development of penicillin Shared Nobel Prize in* physiology and medicine 1945



South America

By **Samuel Guy Inman**

BRAZIL is not only the largest country in South America she is the fourth largest country in the world If you imagine an area the size of the United States with one more state as big as Texas added to it you will have a good idea of the size of Brazil

To the people who live in this immense territory events of great importance came crowding thick and fast one after another all during 1945

To begin with Brazil was giving all she had to defeat Germany There was no time for idleness at the air bases on the big Brazilian hump– the nearest point to Africa in all South America Brazil had loaned these bases to the United States to hasten the air distance across the Atlantic

In Brazil's eastern cities along the coast factories were working full time on war production Inland along the Amazon Valley thousands of workers were struggling to in

crease the production of desperately needed rubber

While Brazil was helping to win the war her people were being ruled by a dictatorial government and they were restless Before the year was over revolution broke out in Brazil as you shall see

In spite of discontent at home, Brazil co-operated with the United States in many important ways No ally could have been more staunch Brazil was one of the members of the Mexico City Conference and gave her approval to the famous Act of Chapultepec which you may read about in the article on Mexico in this ANNUAL

BRAZIL JOINS IN THE WAR AGAINST JAPAN AND RATIFIES THE UNITED NATIONS CHARTER

Brazil declared war on Japan on June 6, 1945 This was welcome news to the United Nations for at that time it looked as if the war in the Pacific was going to be long and very difficult

Later in the year Brazil took part in the San Francisco Conference She ratified the Charter of the United Nations on September 8

In all of Brazil's history there has never been anything like the progress she has made in recent years The man who led Brazil in this swift growth is Getulio Vargas He has done more for the economic development of his country than has any other ruler

Vargas was president of Brazil But he exercised the powers of a dictator With the end of the war Vargas was nearing the end of his long years of rule He had seized power in Brazil in 1930, and for fifteen years he had given the people no chance to elect another president Now most of the people and a large part of the army were clamoring for the right to choose their own president in a free election

DICTATOR VARGAS IS FORCED TO RESIGN AND GENERAL DUTRA IS ELECTED PRESIDENT

Vargas promised to give Brazilians what they wanted All through 1945 he had held out the hope of an election He even set the date for December 2 But the general feeling was very strong that a man who had been so long in office would want to continue

Late in October the army forced Vargas to resign In accordance with the Brazilian Constitution the Chief Justice of the Supreme Court would act as president until an election could be held And so Chief Justice Jose Linhares was sworn in as Brazil's temporary president The United States officially recognized the Linhares Government on November 2

Jose Linhares carried out the promise that Vargas had made A presidential election was held on December 2 Seven million five hundred thousand persons registered for this election General Enrico Gaspar Dutra was elected the president of Brazil Getulio Vargas was elected senator for his state

HOW THE WAR BROUGHT THE NORTH AND SOUTH AMERICAN REPUBLICS TOGETHER IN ACTION

One of the finest results of the war is the new spirit of co-operation between most of the republics of North and South America Brazil shows us many outstanding examples of this spirit One instance of the friendship between Brazil and the United States is the story of an old ship which was sent on an important mission

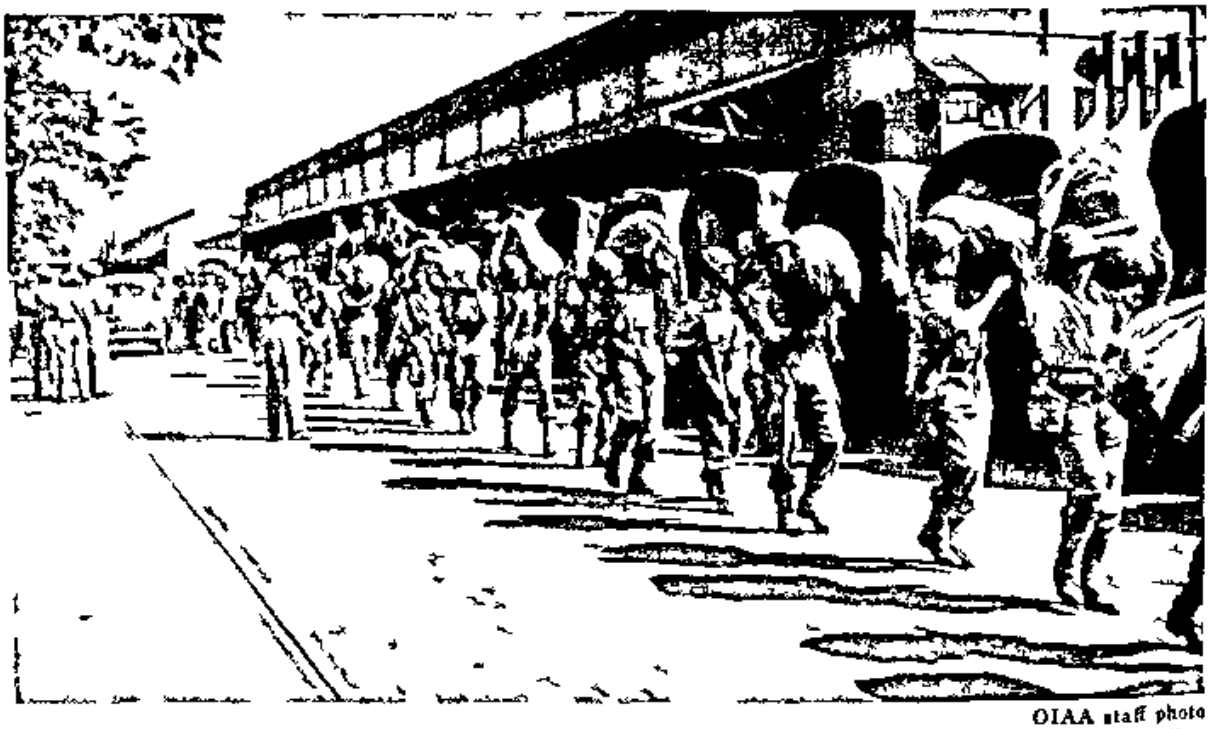
On November 10 1945 an old naval transport steamed into New York Harbor Her name was the Duque de Caxias and she was flying the Brazilian flag Six months earlier she had been called the Orizaba and she flew the Stars and Stripes

Travelers well remember the old Orizaba in the days before the war when they enjoyed many happy voyages aboard The United States had turned the Orizaba over to the Brazilian Government in July Rechristened the Duque de Caxias her business was now more serious She would sail home carrying the last of the several hundred Brazilian veterans who had been wounded in the Italian campaigns and who had then been sent to the United States to recover

UNITED STATES AND BRAZILIAN SOLDIERS HAD FOUGHT SIDE BY SIDE IN WINNING ITALY

Earlier in the year on July 18 Rio de Janeiro Brazil's great capital had welcomed the return of other veterans of the Italian campaigns These were some of the troops of the Brazilian Expeditionary Force What a tremendous burst of joy greeted them as they poured down the gangplanks! They were given a wonderful ovation and as a mark of the good will between their country and the United States they were reviewed by a United States general who had just come from Italy himself—General Mark W Clark

In the long grim struggle in Italy the men from Brazil and the men from the United States had come to know each other well They gained new respect for each other and new friendships were formed that will help both countries to understand each other better now that the war is over



OIAA staff photo

Brazilian soldiers leaving the docks at Rio de Janeiro The Brazilian Expeditionary Force joined with the other Allied forces in driving the Germans out of Italy They were given a tremendous reception upon arriving home

This war marked the first time that Brazilian soldiers ever fought on European soil They fought under North American generals and used guns and tanks made in North America

One of the most important projects that Brazil undertook was her effort to grow rubber in the Amazon Valley Rubber is vital in war and there was a desperate shortage of the natural product because the Japanese had seized the great rubber plantations of Java and Malaya Brazil and the United States speeded up the production of rubber in the Amazon Valley The Brazilian Government sent thousands of workers there Immediately their health became a problem Fevers and heat make the Amazon jungles dangerous to people who are not used to living in that region The United States sent many doctors and nurses to guard the health of the rubber workers

The Amazon Valley may become more and more important in the future It is quite possible that it will become one of the rubber centers of the world And it may become the home of many of the homeless refugees of Europe

Brazil s great West is as untouched as the western part of the United States used to be a century ago Stretching far inland the Amazon Valley is one of the largest and richest undeveloped areas on earth Millions of refugees could settle there with room to spare and build themselves new homes and find new hope for living One difficulty is that it would cost a great deal of money to make the valley a good place for them to live Science would have to tackle the problem of sanitation Great quantities of food would have to be raised and modern farm machinery would have to be introduced

Modern industry is already thriving in the cooler region along the eastern coast Sao Paulo is a great industrial city—the second largest city in Brazil and the third largest in South America With a population of about 1 500 000, Sao Paulo claims to be the most rapidly growing city in the world

On the road between Sao Paulo and Rio de Janeiro lies Volta Redonda with its new steel mill For the first time in their lives thousands of workers in this mill are living in modern homes and sending their children to school

Every great war is followed by new and difficult problems After World War II many countries were faced with the same problems that troubled Brazil Living costs were high Wages were low Food was scarce. Brazil like many of her sister republics needed new plans for a better economic life Her laborers needed better houses More schools were needed too as well as new kinds of schools that would make modern knowledge and modern training available to more Brazilians.

But Brazil s greatest need was for a democratic government and you have read how she solved this problem What happened in Brazil with the coming of peace happened also in many other parts of the world People who had been denied the right to vote and to express their opinions demanded these rights In South America there was a growing shift away from dictatorship toward democracy There were two more revolutions in South America in 1945—one in Venezuela that succeeded and one in Argentina that failed

The revolution in Venezuela took place in October The president of Venezuela was Isaías Medina Angarita On October 19 some of the officers of the army revolted against President Medina and forced him out of office

Caracas the capital was thrown into a turmoil Part of the army remained loyal to Medina and there was fighting between the two groups with riots and looting and bloodshed Romulo Betancourt succeeded Medina as president, but he had to win his position and hold it by the armed strength of his supporters He was confident of victory The next day—October 20—Betancourt assured the United States Embassy that he would soon restore peace and order On October 21 several other army garrisons joined Betancourt s rebel forces and Medina and members of Medina s cabinet were in custody Betancourt had triumphed

As provisional president Betancourt headed a group of seven men to rule Venezuela until an election could be held He promised to help his country establish a democratic government He also promised that delegates would be elected to draw up a new constitution and he promised to hold a presidential election as soon as possible

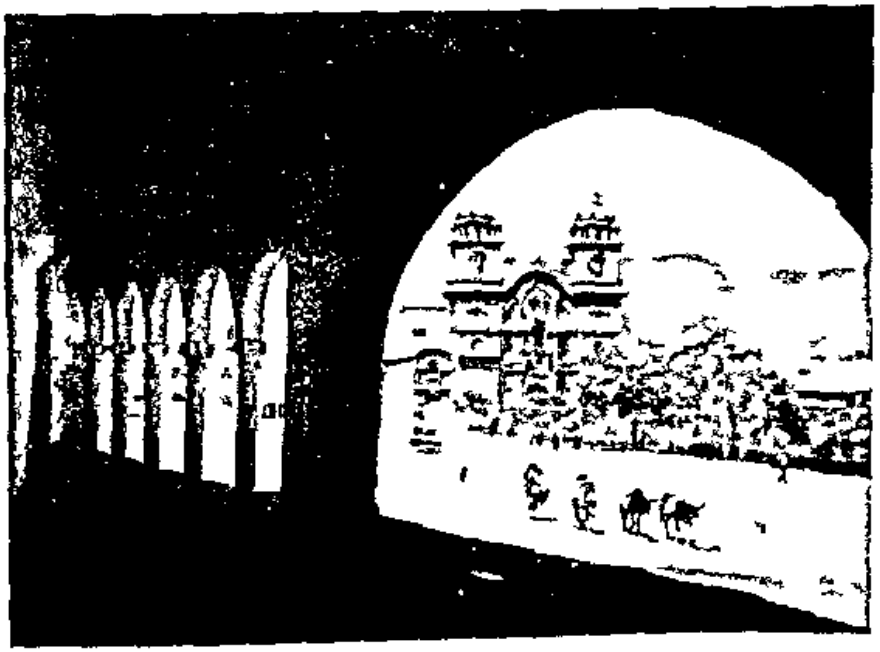
Venezuela has always been governed by a few people who seemed not to be concerned with the country s welfare One of its most famous dictators was Juan Vicente Gómez who died in 1935 Since his death two of his generals ruled Venezuela—General Lopez Contreras and General Medina

For years Venezuela has depended for most of her income on her oil and her big ranches The Betancourt Government has appointed a commission to see what can be done to give Venezuela other sources of income It is hoped that the development of manufacturing and of various kinds of small business may be the answer

Venezuela is made up of small states loosely linked with the central government The Betarcourt Government appointed a commission to study ways for the Government and the states to work more closely together in order to improve the health of the people to give them a better education and to build up a prosperous business life from which all would benefit

The revolution in Argentina did not end on such a hopeful note The government of Argentina is still a dictatorship

Argentina has long been South America s problem child During the war Argentina was hand in glove with the Nazis until the



James Sawders

Once the capital city of the Inca empero s Cuzco has many fine churches dating ba k to the Spanish period

very last moment Argentina did not declare war on Germany until March 27 1945 when Allied victory in Germany was a certainty The German surrender was only a little more than a month away Argentina also declared war on Japan on March 27

When rebellion broke out in Argentina in October there was hope for a little while that a democratic government might take the place of Argentina s dictatorship This hope was short lived

Juan D Perón was the dictator of Argentina His title was vice president but he had more power than the president Edelmiro Farrell because he was able to make Farrell obey his orders

Perón ruled his country with methods very much like those of Hitler and the Nazis Peron was in control of the police who had been trained in the use of machine guns and other deadly weapons Some of the labor unions and a large part of the army also supported Perón Many of the common people, however longed to overthrow him

There had been many demonstrations against this dictator One of the largest demonstrations took place on September 19 in Buenos Aires the capital It was estimated that 500 000 people took part They carried banners They sang songs of freedom They shouted *Viva la Democracia*"—Long Live Democracy

Perón s military government arrested many of the demonstrators There followed a reign of terror In protest more than 30, 000 university students went on a nation wide strike on October 3 Many students were arrested Riots took place which the police put down by firing into the crowds The Government even occupied the six national universities of Argentina

Doctors lawyers and other professional and business groups joined the demonstration on the side of the students and of democracy Finally on October 9, Perón resigned

But the leaders of freedom were slow to act and they were not so highly organized as the supporters of Peron The dictator rallied his forces round him and headed a counter revolution On October 17 Perón was back in power He did not take a government office but he was still the Strong Man of Argentina controlling President Farrell and the country

A presidential election was scheduled to be held on February 24, 1946 Peron announced that he would run for the presidency

Other countries were troubled about Argentina They did not know how they should treat this dictator country The difficulty of making the right choice has caused the



A scene in Colombia Stevedores carrying on board ship bags of coffee and cinchona bark from which the important drug quinine is made

CIAA photo

United States and other American republics to change their attitude several tim s Ar gentina was not present at the Inter Ameri can Conference in Mexico City in the early part of the year But she was taken back into the Pan American family of nations after she had declared war on the Axis and signed the Act of Chapultepec

ARGENTINA IS ONE OF THE UNITED NATIONS BUT HAS STILL REMAINED A DICTATORSHIP

Argentina asked to be invited to the United Nations Conference at San Francisco The United States and Latin America voted to invite her because they hoped it would help to bring constitutional government back to Argentina This hope was not fulfilled Although Argentina ratified the United Na tions Charter (September 8) she was still a dividing force among the countries of the Americas at the end of the year

In striking contrast to Argentina Peru swung to the left in 1945 The July elections for president were won by the Liberal and leftist candidate, Jose Luis Bustamante Ri vero

Peru was the home of aristocracy during colonial days when Spanish grandees ruled the land When the country won its inde pendence, it did not become a democracy but a republic in which a few men had all the say

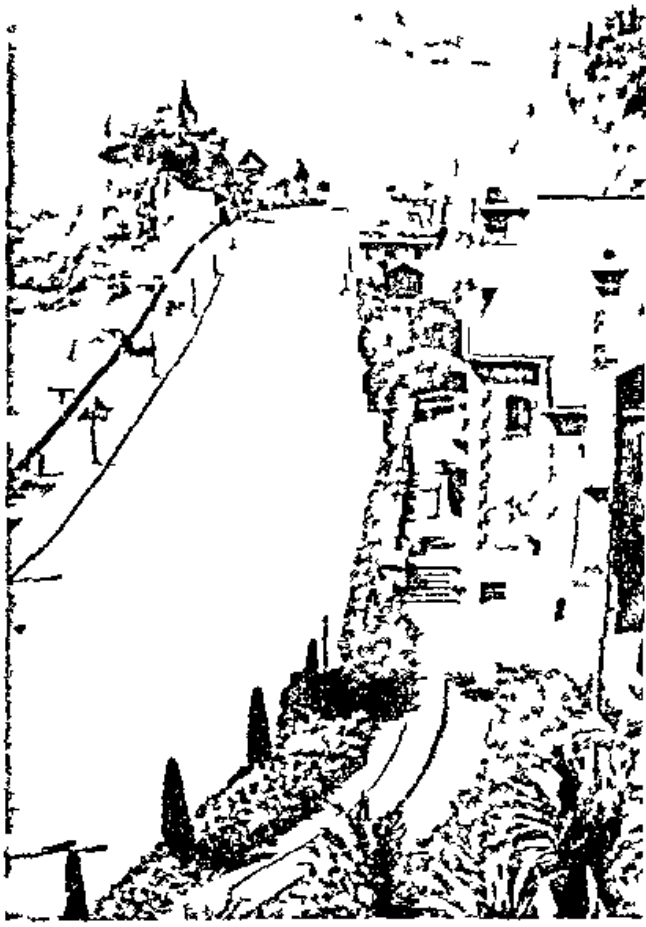
Some twenty years ago a group of students led by a brilliant young man named Haya de la Torre decided to start a movement to change Peru into a democracy They were of course vigorously opposed by the Govern ment and some of them were exiled Other reform parties joined this movement and after many years they finally won the victory for which they had struggled

A LONG STRUGGLE FOR DEMOCRACY IN PERU IS FINALLY RESULTING IN GREATER FREEDOM

The press was granted freedom of expres sion Labor was allowed to organize teachers could express their opinions freely and the National Congress was allowed full liberty of debate

When Haya de la Torre who had been living underground, addressed a huge crowd in Lima the Peruvian capital, he said We do not want bread without liberty or liberty without bread

It is to be hoped that Peru will be able to achieve both bread and liberty But she has a long way to go before those who have been deprived of freedom of expression can truly understand what liberty means They



Grace Line
Viña del Mar Chile's most fashionable seaside resort.

will need to learn that discipline and a re spect for the rights of others are a part of freedom in a democracy

Peru declared war on Germany and Japan on February 12 Two days later along with Paraguay Chile and Ecuador she became a member of the United Nations Peru ratified the United Nations Charter on October 15

As the year drew to a close two countries —Peru and Venezuela—seemed to have been added to the democracies in South and Cen tral America. These include Uruguay Chile Colombia Mexico, Cuba and Costa Rica Turning in the direction of democracy were Guatemala El Salvador and Ecuador

On the side of dictatorship were Argen tina Paraguay, Bolivia the Dominican Re public Haiti Honduras and Nicaragua

It was clear that throughout Latin Amer ica the common people had been so stirred by the war that any dictator might lose his job overnight

We should remember that much of South America has been isolated from world affairs for a long time Now however this isolation is changing New schools are being built More and more people are learning to read and write New books are pouring from the printing presses

Communication among the different coun



Pan Ame an A rways

Chief beast of burden in Peru is the llama It has been in use since the days of the Incas and the Span ards

tries and between North and South America is improving rapidly The Pan American Highway and new airplane routes are being pushed More and more visitors are coming in from other countries The new organization of labor and the improvement of the health of the people are also very important changes

It has been said that one test of civilization is the way a nation treats its children If you believe that this is true you will be interested in what Chile is doing for some of its children

Santiago, the capital of Chile, is building a Children's City in one of its suburbs It will consist of about thirty buildings for orphans and forsaken children The buildings will be named after American republics and heroes There will also be schools a hospital, a library and a theater

Boys and girls in North and South America can do a great deal to further Inter American friendship Many schools might like to follow some of the suggestions that were made in the distant land of Chile These suggestions were recently made by Chile s Minister of Education He put them in a bulletin that he sent to all the pupils of the public schools in that country Here they are

WAYS IN WHICH SCHOOL BOYS AND GIRLS CAN HELP TO BUILD INTER AMERICAN FRIENDSHIP

1 Read about the life of some notable citizen of each American country
2 Celebrate the independence day of each republic.
3 Try to understand the life of these countries especially through their music dances and legends
4 Study the history and geography of each country
5 Read the papers for news of these republics and send a note of sympathy when a national catastrophe overtakes one of them
6 Study the work of such organizations as the Pan American Union, the Rockefeller Foundation and the Red Cross, and the things they do to help the peoples of the Americas understand each other
7 Form Pan American clubs in your schools
8 Exchange letters, student publications and photographs with students in other countries
9 Keep a map of the American continent close to your school flag

A program such as this carried out by a number of schools in American countries would be a powerful influence for good



Photograph from European

Democratic patriots in Buenos Aires Argentina, recently staged a big parade called the March of Constitution and Liberty The photograph shows a crowd of young color guards leading marchers to the Plaza del Congreso

SPORTS REVIEW

By **Leo Waldman**

Courtesy of A G Spalding & Bros, Inc



Hal Newhouser of the Detroit Tigers was the year's outstanding pitcher

BASEBALL once again turned out to be the piece de résistance on the 1945 varied sports calendar Both the American and National Baseball leagues undoubtedly inspired by the return of peace to the world staged never to be forgotten pennant races in their respective circuits—probably the most closely contested and dramatic battles ever staged by our national pastime—with the Detroit Tigers and the Chicago Cubs finally emerging with the coveted championships

Detroit staving off a late challenge by the surging Washington Senators clinched the American League pennant on the final day of the season when Hank Greenberg who rejoined the team in midsummer after being honorably discharged from the Army Air Forces as a captain hit a home run with the bases full in the ninth inning against the St Louis Browns to give his team the necessary triumph by a 6 to 3 score This certainly meant turning the tables because these same Brownies nosed out the Tigers for the 1944 pennant on the very last day of the 1944 campaign

The Cubs didn't make their followers suffer in anxiety until the final playing day They wrapped up their National League pennant on the next to final day of the season beating the Pittsburgh Pirates in a doubleheader The twin victory cut short the St Louis Cardinals ambitions of winning their fourth successive flag Billy Southworth's team had won the bunting in 1942 1943 and 1944 and the manager just missed equaling the record of four consecutive pennant triumphs jointly held by John McGraw and Joe McCarthy

This was the seventh American League pennant won by a Detroit team but the first for Steve O'Neill as manager He finally achieved his ambition after fifteen years of managing teams at Toronto Toledo Cleveland, Buffalo, Beaumont and finally Detroit O'Neill however was the No 1 catcher of the Cleveland team which won the American League pennant and beat Brooklyn in the World Series of 1920

Detroit was far from the greatest team ever to win a pennant Most of the club's stars like those of other teams were on leave serving with the armed forces but O'Neill put together a veteran combination with the available material and it turned out to be the best in the loop It was one of the oldest pennant winning aggregations, the team averaged well over thirty years of age Doc Cramer the centerfielder Paul Richards the first string catcher Hank Greenberg and Tommy Bridges the pitcher have all passed their thirty fourth milestone but they combined hustle opportunism and skill to come out on top

Despite the fact that he had been in the Air Forces for four years serving in India China and the Pacific Greenberg was just as good as ever when he rejoined the Tigers And his big bat was the deciding factor in the pennant race It was this same big Greenberg who knocked out fifty eight home runs during the 1938 campaign—only two away from Babe Ruth's all time major league record according to the official records printed in Spalding's Baseball Guide

Hal Newhouser Paul (Dizzy) Trout and Alton Benton were the pitching standouts for O'Neill's forces Newhouser twenty four year-old southpaw, won twenty five games tops in both major leagues Trout despite

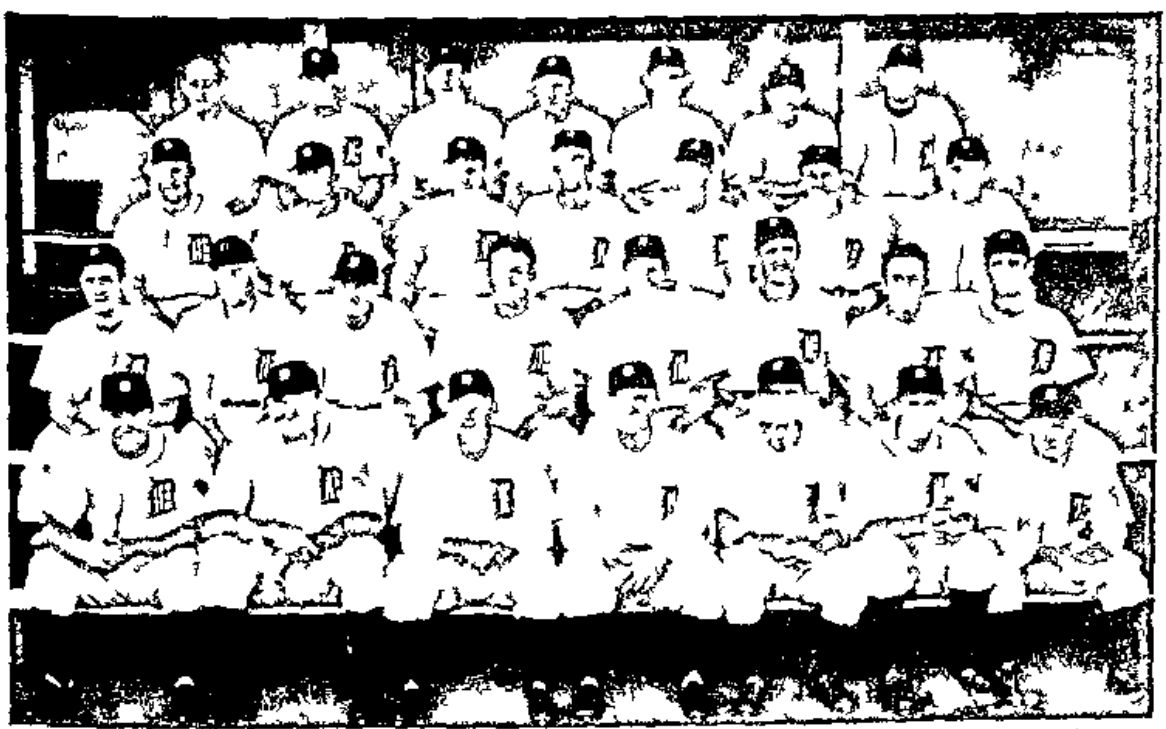
the fact that he was bothered by a sore arm won eighteen Benton came up with thirteen conquests Detroit took over first place on June 12 Washington moved within a half game of first place on four different occasions but one or another of these three star pitchers came through with a stellar performance to keep the team on top of the standings

In capturing the National League flag its sixteenth since 1876 the Chicago team established a new record for most pennants won It had previously been tied with the New York Giants each with fifteen Jolly Charley Grimm managed the Cubs in their winning drive—the fourth time he has been with a pennant winning Chicago nine He was the first baseman on the team which won in 1929 and he was manager of the aggregations which came out on top in 1932 and 1935

The Cardinals and Brooklyn Dodgers gave the Chicago team a tough run for the big prize during the season but the Cubs had an outstanding pitching staff hurlers who were at their best when the pressure was on and this advantage proved the difference There was Hank Wyse consistent all season and owner of twenty two triumphs Hank Borowy, purchased for $100 000 from the New York Yankees in mid season turned out to be a bargain purchase winning eleven games and losing only two And three old timers Claude Passeau Paul Derringer and Ray Prim taught the young opposing batsmen a few tricks and they turned in a combined total of forty six conquests

Phil Cavarretta like Greenberg with the Detroit team was the big gun in Chicago's attack This slick fielding first baseman wielded the most potent bat in the major leagues capturing the National League batting crown with an average of 355—particularly outstanding when compared to the 309 which won the American League honors for George Sternweiss second baseman for the New York Yankees Ably assisting Cavarretta in banging out hits were Andy Lafko Peanuts Lowrey Bill (Swish) Nicholson Stan Hack and Don Johnson These fence busters helped the Cubs sweep twenty doubleheaders during the season—an advantage which went a long way in deciding the race

The two pennant winners came together in the forty second World Series classic and again they staged a thrilling show They fought hammer and tongs right up to the seventh and final game but Detroit boasted the best pitcher in baseball in Newhouser and he proved to be the difference as the Tigers won the series four games to three



Baseball's world champions for 1945, the Detroit Tigers won their crown by beating out the Washington Senators for the American League pennant, and then whipping the Chicago Cubs of the National League in the World Series

The final standings of the teams in both the American and National leagues as reprinted in Spalding's Baseball Guide follow

American League

Team	W	L	Pct
Detroit	88	65	575
Washington	87	67	565
St Louis	81	70	536
New York	8	71	533
Cleveland	73	73	503
Chicago	71	78	4 7
Boston	71	83	461
Philadelphia	52	98	347

National League

Chicago	98	56	636
St Louis	95	59	617
Brooklyn	87	67	565
Pittsburgh	82	72	532
New York	78	74	513
Boston	67	85	441
Cincinnati	61	93	396
Philadelphia	46	108	299

Chicago won the opening game with Borowy hurling a 9 to 0 shutout but the Tigers evened it up when Virgil Trucks fresh out of the Navy turned back the Windy City nine 4 to 1 in the second game Passeau turned in the best game ever pitched in a World Series holding the Tigers to one hit for a 3 to-0 triumph and again giving Chicago a one-game lead Trout put Detroit back on even terms with a 4 to 1 victory in the fourth clash And then Detroit took the lead for the first time in the series when Newhouser coasted to an 8 to-4 conquest The irrepressible Cubs fought back and evened the series at three games all with a dramatic twelve inning 8 to-7 victory But in the deciding game Newhouser had the stuff to hold the Cubs at bay while the Detroit sluggers paced by Greenberg and Richards banged out a 9-to-3 triumph for the world's championship

It was Detroit's second World Series championship and it had scored its only previous one over another Chicago team in 1935 Cramer led the Detroit batters with a percentage of 379 but Greenberg was the big slugger, socking two home runs and batting in seven tallies Cavarretta paced both teams in hitting with a mark of .423 but he received little support from his Chicago team mates Richards was the hero of the most important victory the final game when his two crashing doubles knocked four runs across the plate This was Chicago's seventh straight World Series defeat since their last championship back in 1908

It was the richest World Series ever played A total record crowd of 333,457 for the seven games boosted the final receipts to a new high of $1 592,454 It was the fifteenth $1 000 000 series in forty two years The previous record for receipts was $1 322 328 compiled when the Tigers and Cincinnati Reds met in 1940 Each Detroit player received a winning share of $6,445 while each Chicago player earned the smaller slice of $3 970

The score by innings of the seven World Series games follows

	W	L	Pct
Detroit (A L)	4	3	571
Chicago (N L)	3	4	429

First game at Detroit—

				R	H	E
Chicago (N L)	403	000	200	9	13	0
Detroit (A L)	000	000	000	0	6	0

Batteries—Borowy and Livingston Newhouser Benton (3) Tobin (5) Mueller (8) and Richards.

Second game at Detroit—

				R.	H	E.
Chicago (N L)	000	100	000	1	7	0
Detroit (A L)	000	040	00x	4	7	0

Batteries—Wyse Erickson (7) and Gillespie Trucks and Richards

Third game at Detroit—

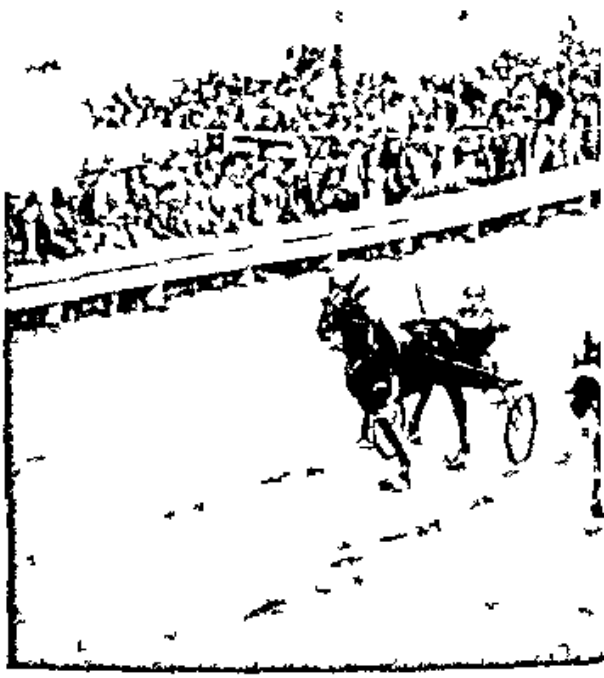
				R.	H	E.
Chicago (N L)	000	200	100	3	8	0
Detroit (A L)	000	000	000	0	1	1

Batteries—Passeau and Livingston Overmire Benton (7) and Swift Richards (7)

Fourth game at Chicago—

				R	H	E
Detroit (A L)	000	400	000	4	7	1
Chicago (N L)	000	001	000	1	5	1

Batteries—Trout and Richards, Prim Derringer (4) Vandenberg (6) Erickson (8) and Livingston



Titan Hanover the horse of the year in harness racing.

Fifth game at Chicago—				R	H	E
Detroit (A L)	001	004	102	8	11	0
Chicago (N L)	001	000	201	4	7	2

Batteries—Newhouser and Richards Borowy Vandenberg (6) Chipman (6) Derringer (7) Erickson (9) and Livingston

Sixth game at Chicago—					R	H	F
Detroit (A L)	010	000	240	000	7	13	2
Chicago (N L)	000	041	200	001	8	15	3

Batteries—Trucks Caster (5) Bridges (6) Benton (7) Trout (8) and Richards Swift (6) Passeau Wyse (7), Prim (8) Borowy (9) and Livingston Williams (10)

Seventh game at Chicago—				R	H	E
Detroit (A L)	510	000	120	9	9	1
Chicago (N L)	100	100	010	3	10	0

Batteries—Newhouser and Richards Swift (8) Borowy Derringer (1) Vandenberg (2) Erickson (6) Passeau (8) Wyse (9) and Livingston

The owners of the sixteen major league teams appointed a new high commissioner of baseball Senator Albert B (Happy) Chandler, on April 23 to succeed the late Judge Kenesaw Mountain Landis who had ruled the game since the establishment of the commissioner's office back in 1920 Chandler forty six years old had been governor of Kentucky twice and a member of the United States Senate for two terms The new boss of baseball was born in Versailles Kentucky, obtained his college degree at Transylvania and his legal education at Harvard He resigned from the Senate in November to devote his full time to baseball

President Harry S Truman honored baseball by taking in the Washington St Louis game at Griffith Stadium in the Capital on September 8 He was the first president to attend a mid season ball game since 1930 President Truman has long been a baseball fan and frequently attended games as a senator He did not throw out the traditional first ball at the opening game of the season because it occurred during the mourning period for the late President Franklin Delano Roosevelt

There was one no hit game during the season and it was pitched by Dick Fowler twenty-one year old righthander for the Philadelphia Athletics who was making his first starting appearance after being discharged from the Canadian Army The youngster blanked the Browns 1 to 0 on September 9 at Shibe Park Philadelphia It was the first no hitter in the American League since 1940 when Bob Feller of Cleveland blanked the White Sox on the opening day of the season Fowler struck out six, walked four and faced only twenty nine batsmen

The year s Most Valuable Player title was awarded in the National League to Phil Cavaretta star first baseman of the pennant winning Chicago Cubs In the American League Hal Newhouser, ace lefthanded hurler of the



Photograph by Bert Morgan courtesy The Rider and The Driver

winning the first heat of the historic Hambletonian trotting classic at Goshen, New York on August 8

world s champion Detroit Tigers, won the honor for the second year in a row

After the season s close the Boston Braves announced that they had signed Billy South worth as their 1946 manager Southworth who had led the St Louis Cardinals to three straight pennants, parted amicably with Card president Sam Breadon in returning to Beantown where he once played as an out fielder The Card nals reported that their new manager would be Eddie Dyer former director of the St Louis farm clubs

More fans watched major league baseball in 1945 than ever before Five teams passed the million mark in paid admissions Detroit Chicago Cubs New York Yankees New York Giants and Brooklyn and the overall total for the sixteen clubs soared to the re cord high of 11 375 185 The previous re cord was 10 281 891 made in 1940 Detroit had the largest individual 1945 high with 1 280 321

MOST OF BOXING S CHAMPIONS SERVED IN THE ARMED FORCES DURING THE WAR

Boxing made a tremendous contribution to the war effort during the last year Vir tually every divisional champion served in some branch of the service Joe Louis the heavyweight king was a technical sergeant in the Army Gus Lesnevich the light heavy weight boss Tony Zale middlewe ght king and Freddy (Red) Cochrane the welter weight ruler all served in Uncle Sam s Navy Bob Montgomery the lightweight title hold er New York version wore an Army uni form Willie Pep and Sal Bartolo co holders of the featherweight crown the former rec ognized in New York and Connecticut and the latter by the National Boxing Associa tion served in the Army and Merchant Ma rine respectively Manuel Ortiz the bantam weight kingpin also served in the Army and Peter Kane flyweight title holder from Eng land served in the British armed forces Only Ike Williams who is recognized as lightweight champion by the N B A , was not able to serve in the armed forces because of a physical handicap

Louis whose real name is Joseph L Bar row was awarded the Legion of Merit for exceptionally meritorious conduct in the performance of outstanding services travel ing in European Mediterranean and North African theaters and volunteering his serv ices at considerable risk to his boxing future as heavyweight champion of the world

Louis and his chief heavyweight rival Billy Conn were both discharged from the Army in September and immediately plans were put into operation to bring the behe moths together in another big fight prob ably some time during the summer of 1946 It will be recalled that Louis successfully de fended his crown against Conn a few years ago by knocking out the good looking Pitts burgh battler in the thirteenth round The ring records of both of these performers are listed in Spalding s Boxing Guide Louis now th rty one years of age had been in the Army since January, 1942 and had enter tained more than 2 500 000 men with exhibi tion bouts earning two battle stars in addi tion to the Legion of Merit medal

Red Cochrane the welterweight champi on was discharged from the Navy as a ch ef petty officer and he immediately started training for another title—but this one was for a Bachelor of Science degree in physical education The thirty year-old veteran from Union New Jersey who won his crown from Fritzie Zivic in 1942 enrolled at Seton Hall College after his discharge and planned for a career as a teacher when his boxing days came to an end Cochrane s course of study included American history English religion public speaking and physical education He had served in the Navy close to four years mostly in the Pacific area

Pep had a distinctive honor He served in both the Navy and the Army—the only na tionally known athlete to serve in both branches of the service He was inducted into the Navy early in 1944 but was dis charged later that year because of an injured leg About four months later the Army de cided he was physically fit and again he was in uniform He received his second discharge October 3 1945 Between his two enlist ments he defended his title once beating Phil Terranova of New York over fifteen rounds on February 19 1945 at Madison Square Garden In e ghty seven professional bouts Pep one of the classiest boxers ever seen in a ring has lost only once

IKE WILLIAMS CAPTURES THE LIGHTWEIGHT CROWN FROM JUAN ZURITA IN MEXICO CITY

Besides the Pep Terranova title bout there was only one other championsh p fight during the year Ike Williams, a resident of Trenton New Jersey won the N B A light weight crown from Juan Zurita of Mexico via a third round knockout on April 18 be fore a capacity crowd in Mexico City Wil liams however, will never be classified as a great champion In four meetings with Will e Joyce of Cary, Indiana, Williams lost three

times the last on June 8 at Madison Square Garden—all non title affairs

One of the hardest hitters ever developed among the smaller fighters came up from the ranks He was Rocky Graziano a twenty year old youngster from Brooklyn Only an unheralded club fighter a year ago the Italian lad skyrocketed to fame by knocking out five consecutive opponents at Madison Square Garden The fight fans always go for a knockout artist and Graziano attracted a total of $400 000 in gate receipts for these five bouts The biggest gate of the indoor season 18 540 fans and $103 970 in receipts was recorded when Graziano knocked out Harold Green in three rounds on September 29 1945

England crowned a new heavyweight champion for Great Britain and the British Isles when Bruce Woodcock knocked out the veteran defending title holder Jack London in the sixth round Woodcock only twenty four eight years younger than London kept his record unblemished with his twentieth consecutive victory nineteen of them recorded by knockouts

The big news in the track and field world was furnished by Gunder (the Wunder) Hagg Sweden s haberdashery salesman and probably the greatest distance runner of all time On July 17 in a meet at Malmo Sweden Hagg clicked off a world record shattering mile in 4 01.4 This surpassed the previous standard 4 02 6 made by Arne Andersson also of Sweden and Hagg s chief rival on July 1 1943 And the four minute mile long considered an impossibility by many leading track and field experts is now within reach In fact Hagg has announced that he will do a mile in four minutes before he retires from running

Following is a brief summary of some of the mile records through the years as listed in Spalding s Track and Field Guide

Year	Athlete and country	Time
1865	Webster England	4 44 3
1881	George England	4 18 8
1913	Jones United States	4 14
1915	Taber United States	4 14 6
1923	Nurmi Finland	4 10 4
1931	Lovelock France	4 09 2
1934	Cunningham United States	4 06
1937	Wooderson England	4 06
1942	Hagg Sweden	4 04 6
	Hagg Sweden	4 04
	Andersson Sweden	4 04
1943	Hagg Sweden	4 01 4
1945		

The New York Athletic Club dominated the 1945 outdoor competition The Winged Foot retained the national A A U senior title with 74 points at Randall s Island New York with the New York Pioneer Club second with 48 tallies And the Winged Foot also won the national junior team honors with 59 points The Pioneer Club was again second with 50 points

Roland Sink nineteen year-old youngster from Los Angeles was the big surprise of the outdoor nationals by capturing the coveted 1 500 meter crown in what may be the beginning of a long reign as America s premier miler A Navy student at Harvard Sink beat Tommy Quinn of the New York A C by ten yards in 3 58 4—which is equivalent to a 4 16 mile The time was not particularly fast but the 100 degree temperature spoiled any chances for record performances

The United States Naval Academy came up with the best outdoor track and field squad in the college ranks and the Mid



Courtesy University of Pennsylvania

School relay teams run in the annual Penn Relay Carnival at Philadelphia

des retained their Intercollegiate A.A.A.A. outdoor team championship with 85¾ points—a record total—and also won the National Collegiate A.A. crown with 62 points. The University of Illinois won the Western Conference championship while the United States Military Academy and the University of Michigan won practically everything at the annual Penn Relays at Philadelphia accounting for seven of the eight championship relays.

FORMER FORDHAM MILER JIM RAFFERTY WINS TEN STRAIGHT RACES ON INDOOR TRACKS

Jim Rafferty, twenty-nine years old and a graduate from Fordham eight years ago, was the big star of the indoor campaign, winning ten straight mile races for an unbeaten season. His fastest mile was 4:10.9, but Rafferty, an accountant during working hours, was not inclined to set records but ran each race just fast enough to win. Gilbert Dodds, the 1944 champion, gave up running to accept an assignment with a touring gospel group. He had studied for the ministry at the Boston Theological School.

Hagg and his countryman Haakon Lidman visited the United States during the indoor season, but neither was very successful. Hagg lost all of his four races and constantly complained that the American indoor banked tracks were not suitable for his type of running. Lidman, a hurdler, won a few races but an injured knee hampered his training.

Sergeant Frank Parker retained his top ranking as the country's outstanding tennis player. The sergeant, stationed in the Pacific, flew in from Guam and successfully defended his national singles championship at West Side Tennis Club, Forest Hills, New York, beating Billy Talbert of Cincinnati in straight sets, 14-12, 6-1, 6-2. Parker and Talbert are sure to be on the United States team when the Davis Cup competition is resumed in 1946.

Although he failed in the singles, Talbert won two other championships. He teamed with Lieutenant Gardner Mulloy and won the national doubles honors by beating Aviation Cadet Bob Falkenburg and Jack Tuero. This was the second time Talbert and Mulloy won the doubles title. They also turned the trick in 1942. Talbert also teamed with Margaret Osborne for the national mixed doubles bauble, downing Falkenburg and Doris Hart.

Pauline Betz of Los Angeles, winner of the women's national singles championship in 1942, 1943 and 1944, lost the chance of equaling Helen Hull Jacobs' feat of winning four consecutive titles by succumbing to Mrs. Sarah Palfrey Cooke, of Boston, 3-6, 8-6, 6-4. Mrs. Cooke, wife of Elwood Cooke, also one of the country's top players before joining the Navy, had retired from competition after winning the crown in 1941 and she celebrated her return to the sport by garnering her second championship.

While Miss Betz failed in seeking her fourth title, Louise Brough and Miss Osborne succeeded. This combine teamed perfectly and won the women's doubles title for the fourth successive year, conquering Miss Betz and Miss Hart, 6-4, 6-4.

Byron Nelson, voted the year's top male athlete, was Mr. Golf of 1945. The thirty-three year old links artist won almost every important tournament from coast to coast. He rolled up victories in such places as Charlotte, Greensboro, Durham, Atlanta, Montreal, Philadelphia, Corpus Christi, Chicago and Ft. Worth. All in all, he won nineteen tournaments and approximately $67,000 in prize money for his great play—a figure never achieved before by a golf professional. His most important triumph was the P.G.A. in which he beat Sam Byrd, of Detroit, in the final round.

The United States Golf Association, the body which controls the National Open, the National Amateur, the Women's National Amateur and the National Public Links tournaments, again canceled these four major fixtures because of war conditions. But soon after V-J day, the association announced that all four tournaments will be resumed in 1946 after a lapse of four years.

With the European war over, the British P.G.A. tournament was resumed and Corporal Charley Ward of Britain's Royal Air Force won the title with a seventy-two hole score of 298. Corporal Lloyd Mangrum of Los Angeles and United States champion in the Eastern theater, missed his chance for the crown on the third round with a 79 for a total of 302.

Mrs. Mildred (Babe) Didrikson Zaharias retained her western open title and was selected as the outstanding woman athlete of the year.

OKLAHOMA AGGIES RUN OFF WITH NATIONAL HONORS IN BASKETBALL COMPETITION

Basketball had another terrific year again, establishing new attendance records. The Oklahoma A. & M. quintet earned the national mythical championship honors by stopping DePaul University, 52 to 44, in a

charity game in Madison Square Garden before more than 18 000 people The contest raised more than $50 000 for the American Red Cross

Oklahoma qualified for the Red Cross game by winning the National Collegiate A.A crown beating New York University, 49 to 45 in the final round And DePaul earned the Red Cross invitation by whacking Bowling Green 71 to 54 in the final of the eighth annual national invitation tourney A total of 442 243 fans paid their way into Madison Square Garden for twenty six double headers—a record total

The United States Military Academy quintet beat the Naval Academy 50 to 48 closing its season with a record of fourteen victories against one defeat—this coming from the University of Pennsylvania and breaking a twenty seven game winning streak which started three years ago The University of Iowa won the Western Conference championship And Vince Hanson of Washington State was the country s leading scorer with 592 points George Mikan set an individual scoring record pouring fifty three points through the hoop as his DePaul team beat Rhode Island State

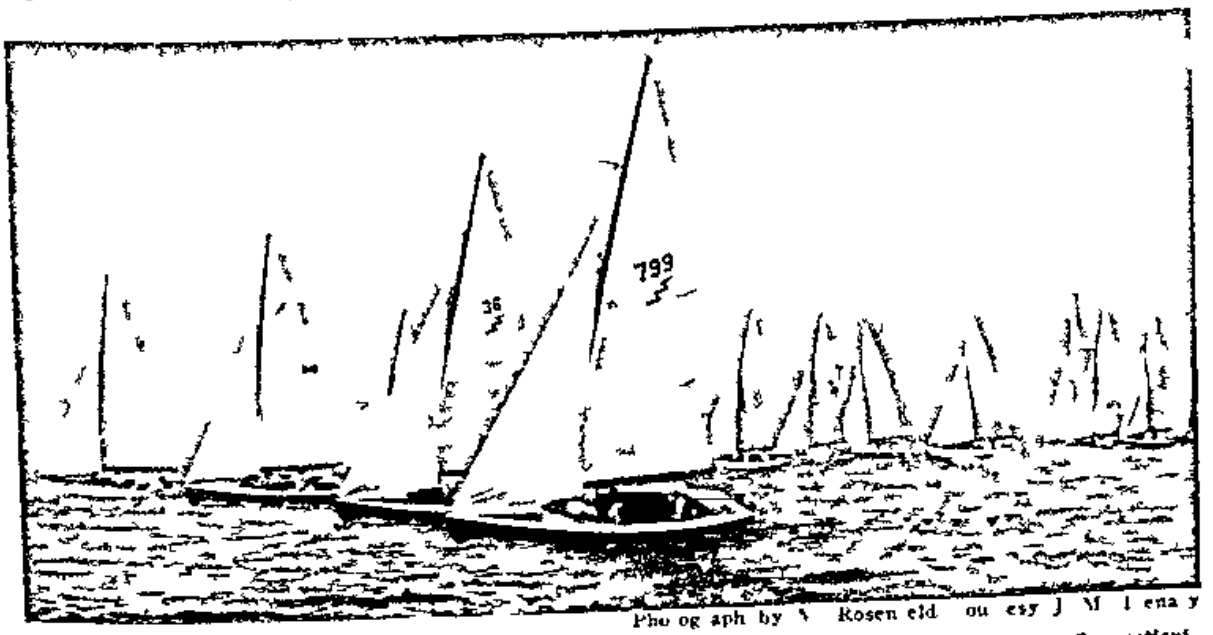
In the first 1945 gridiron game the Green Bay Packers defeated the College All Stars 19 to 7 in the twelfth annual All Star classic at Soldier Field Chicago before 92 753 spectators on August 31 The Packers earned the right to meet the former college stars by winning the National Football League championship stopping the Washington Redskins in the final play-offs of 1944

The year s college football was dominated as never before by one team—Army The greatest West Point eleven in history crushed all opponents in steam roller fashion as it marched to a record of eighteen consecutive triumphs made over a two year span

Colonel Earl (Red) Blaik s outfit led by one of the most explosive one two punches in pigskin memory Glenn (Junior) Davis and Felix (Doc) Blanchard blasted their three big rivals Notre Dame Pennsylvania and Navy by 48-0 61-0 and 32 13 counts

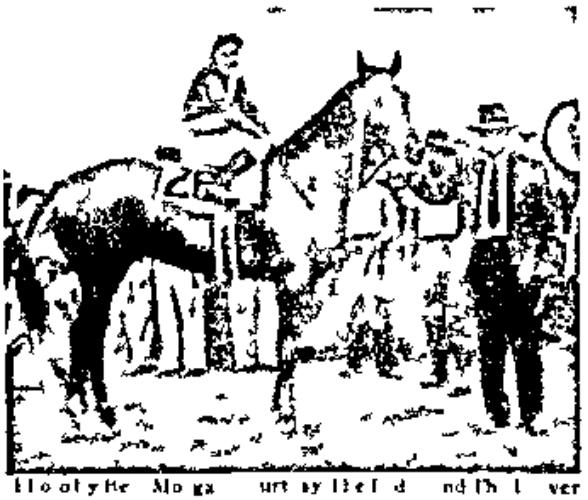
Across the country Indiana beat out Michigan for the Western Conference title Alabama reigned supreme in the Southland and Oklahoma A & M was the class of the Southwest On the West Coast St Marys was tops but in conference play the University of Southern California grabbed the crown and with it a bid to meet Alabama in the Rose Bowl The Sugar Bowl pitted St Mary s against Oklahoma A & M the Cotton Bowl matched Missouri and the University of Texas the Oil Bowl featured Tulsa versus the University of Georgia and the Orange Bowl listed Holy Cross and the University of Miami

In the 1945 National Professional League play-off the youthful Cleveland Rams Western winners pitted their Bob Waterfield Jim Benton pitch and-catch duo against the ageless Sammy Baugh and the Washington Redskins Eastern half titlists



Photograph by V Rosenfeld courtesy J M Lenahy

One of the races in the International Regatta of the Lightning Class gets under way at Riverside Connecticut



Star Pilot with Jockey Kirkland up won the fifty sixth running of the Futurity at Belmont Park

The Rams won the championship 15 to 14 as Waterfield starred with two touchdown passes

The Montreal Canadiens and the Toronto Maple Leafs shared hockey's major honors The Canadiens finished on top in the final standings of the National Hockey League and the Maple Leafs won the cherished Stanley Cup play-offs turning back the Detroit Red Wings in a thrilling seven game series The Maple Leafs won the first three games of the play-offs the world series of hockey but the Red Wings came right back won the next three and tied the series In the seventh and final battle Toronto eked out a 2 to 1 decision before 14 890 fans the largest crowd to watch a hockey game in Detroit history

Elmer Lach of the Canadiens was voted the Hart Trophy awarded annually to the National Hockey League player voted the most valuable to his team for the season

Alan Ford captain of Yale's team was the outstanding individual performer in swimming A native of Balboa of the Canal Zone Ford was a Navy V 12 trainee at Yale during the past year He established himself as the country's current fastest free style aquatic sprinter by setting an assortment of records In his final appearance in a Yale swimming suit he bettered the world's 100 yard free style record in his college's twenty yard pool sizzling over the distance in 49.4 seconds The previous mark was 49 8 seconds made by the famed Johnny Weissmuller in 1928 Ford also holds the international 100 yard mark for the standard twenty five yard pool of 49 7 seconds

In a dual meet with the United States Military Academy Ford won the 50 and 100-yard free style events but the Cadets still managed to win the team honors 44 to 31 The setback broke Yale's sixty-six-dual meet winning streak Michigan State won the national A A U team crown with 26 points three more than that scored by the Great Lakes Naval Training Station The University of Michigan won the Western Conference crown beating Ohio State but the Buckeyes reversed the decision in the National Collegiate A A championships

Crew racing again went through a curtailed campaign with only Columbia Massachusetts Institute of Technology, Cornell and the United States Naval Academy sending boats into the water Columbia claimed what honors there were beating all except Cornell

THE POUGHKEEPSIE REGATTA CREW RACING'S BIG EVENT WILL PROBABLY BE RESUMED

The annual Poughkeepsie Regatta which annually brought together college crews from coast to coast but which has been canceled since 1941 will probably be resumed on the Hudson River in 1946

Yachting also was conducted on a minor scale but such fixtures as the Larchmont Race Week and the Manhasset Bay Yacht Club's fall race series were continued on Long Island Sound Cornelius Shields probably had the most success with his Aileen He won the Royal Bermuda Yacht Club trophy and the season's series in the International Class

Soon after V J day yachting officials immediately announced that the sport will go back to a heavy schedule next year The first international ocean going race since the war broke out in Europe the test across the Gulf Stream from Newport or New London to Bermuda has already been scheduled for June

SIR MALCOLM CAMPBELL WILL ATTEMPT TO SET A NEW MOTORBOAT SPEED RECORD

Motorboating has been at a complete standstill since the war started but the boats will be back in 1946 Sir Malcolm Campbell the first man to attain a speed of 150 miles an hour in an automobile and who later raised the mark to 300 miles an hour is going to make an attempt to push his speed boat Bluebird II above the 150 mile-an hour mark he announced in London shortly after the war ended The Bluebird II which has already done 141 74 miles an hour has been lying idle in the garage throughout the war

Horse racing came up with some brilliant

thoroughbreds Louis B Mayer s Busher a filly was the outstanding three year-old of the season Mrs Elizabeth Graham s Maine Chance Farm boasted two great two year olds Beaugay a filly and Star Pilot a colt And Mrs Ethel D Jacobs Stymie was the fastest among the older handicap horses All of these thoroughbreds won at least $100 000 in purses during the season

THE BIG THREE YEAR OLD RACES OF THE YEAR SEE THREE DIFFERENT WINNERS

F W Hooper s Hoop Jr won the Ken tucky Derby Classic at Churchill Downs Mrs P A B Widener s Polynesian captured the Preakness at Pimlico and Walter M Jef fords Pavot came out on top in the Belmont Stakes at Belmont Park in the big three year old races Incidentally Pavot which went unbeaten in eight races and was named the juvenile champion of 1944 was unable to win another race after his conquest in the Belmont Stakes

Titan Hanover a bay three-year-old son of Calumet Chuck and jointly owned by E Roland Harriman and Major E G Gerry was king among the harness horses He won the sport s most important event the Ham bletonian in two straight heats at Goshen N Y Purchased for $3,000 as a yearling Titan Hanover has already won more than $50 000 in purses Titan was the first two year-old ever to trot a mile in two minutes flat and is unbeaten both as a two-year-old and as a three year-old

EXTERMINATOR ONE OF THE GREATEST RACE HORSES OF ALL TIME DIES AT THIRTY

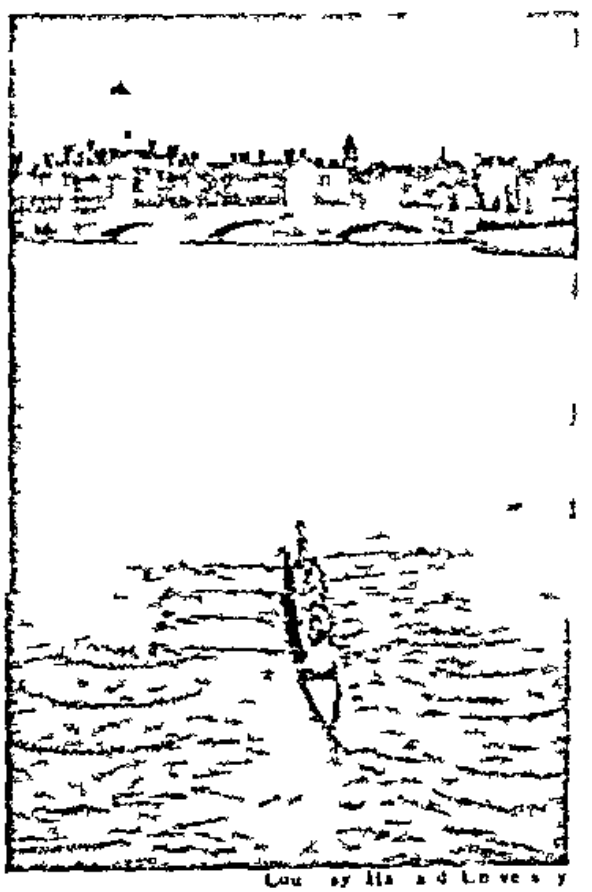
Exterminator, regarded by many turfmen as the greatest race horse in h story d ed last September 26 at the venerable age of thirty at the farm of its owner Mrs Will s Sharpe Kilmer Known as Old Bones Extermina tor competed in 100 races and won exactly half of them Among h s conquests were the Kentucky Derby Saratoga Cup three times the Pimlico Cup three times the Latonia Toronto and Autumn Gold Cups and Brook lyn Handicap

Dernell Every of New York continued rolling up victories on the fencing strips The veteran regained the national foil title an honor he held in 1938 and 1940 Tibor Nyi las also of New York retained his national saber crown while Mack Gilman a new comer from Illinois won the national épee weapon

Joe Platak first class seaman in the Navy regained his supremacy among the country s handball players He had held the national A A U four wall singles championship for eight consecutive years before Frank Coyle of the New York A C beat him in 1944 But Platak came back stronger than ever and beat this same Coyle in the 1945 final 21 19 21 8

Dog fanciers as usual had an enjoyable year despite the fact that most shows were limited because of transportation difficulties Mr and Mrs T H Snethen gained the most coveted honor of the year when their Shiel ing s Signature an unheralded Scottish Ter rier won Westminster s best in show a yard at Madison Square Garden on February 13 This was the first time the breed won the title at this annual fixture in thirty five years

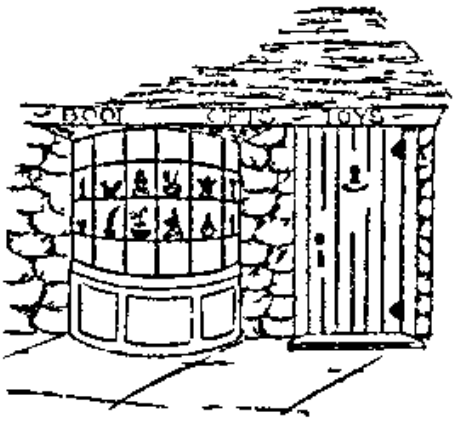
With the war over the cognoscenti in the field of sport predict that 1946 will see the return of compet tion on the pre war scale and that spectator interest in athletics will enjoy a terrific boom The airplane is ex pected to play an important part in this new sports era International competition is sure to increase now that peace is here



Courtesy Harvard University

An eight man shell on the Charles River at Boston.

A SMALL STORE OF YOUR OWN



By Wilford L White

Acting Chief Division of Small Business
United States Department of Commerce

HAVE you ever thought that you would like to own a candy kitchen or a grocery store or a hardware store with a display of shiny tools? Take for example a grocery store The next time you go into one look about you There is a can of coffee It may have come from South America probably Brazil Over there is a jar of olives possibly from Spain Look at that row of boxes containing spices Some of them came from the West Indies Africa China India or Yugoslavia There is hardly a shelf which does not contain something which came from a foreign country It may be something cured under the tropical sun shipped part of the way on camel or donkey back and handled by men and women in foreign dress who speak foreign tongues

The storekeeper brings all these products together from all the ends of the earth He purchases them in large quantities through importers and wholesalers and sells them in small amounts Because he sells in this way he is called a retailer The verb to retail means to sell in small amounts

About as long as you can remember you have known what a retail store is Such stores are everywhere in little communities as well as in big cities They range from huge department stores to very small shops

There are many different types of retail stores as you know from your own experience If you live in a city, you know that department stores have a great variety of goods, sometimes including even food products You know that neighborhood stores near your home sell groceries and drugs and hardware You are also familiar with stores selling furniture jewelry, clothing tires millinery and men's hats These stores are owned and operated by retailers who invest a great deal of money in buying the goods they wish to sell at a profit

Did you ever stop to consider how important these retailers are and what they do for you and your friends? Just suppose that all the stores near your home disappeared overnight Where would you get your groceries? Your dresses or suits or shoes? Your sodas and candy? If you could not buy such things in a near by town you would have to seek out where the wholesalers and manufacturers are who sell what you want Then you would have to go to them all That would be difficult if not impossible since one manufacturer makes only chocolate bars another makes nothing but breakfast food another makes only shoes and so on You would be very hungry and very tired before you had what you needed

Retailers from whom you buy serve as your purchasing agents It is their business to have what you want when you want it in the right size style or color and to sell it to you at a reasonable price Storekeeping is a real job It takes training and experience but it can be a lot of fun

Because so many persons are interested there will probably be 500 000 new stores opened in the United States this year Now during the time those 500 0 0 new stores are opening up about 500 000 other stores will close their doors That means that at the end of the year the total number of stores will be about the same as it was at the beginning

Why do so many stores close? During the recent war, there were three main reasons (1) the storekeepers could not buy merchandise to sell (2) they could not hire new workers to take the place of those who left and (3) many storekeepers left to join the

armed forces During the war, hundreds of thousands of stores—most of which were small—were obliged to go out of business

But many stores, large and small, went out of business before the war—usually more than one thousand a day Why did these stores close? Well, most of them had failed to make a living for their owners Often the trouble was even worse Many of the storekeepers had gone into debt and could not make enough money to pay their bills To owe money which you can not pay is a disaster Such disasters happened to thousands of storekeepers, and it is important for you to understand why they happened Primarily, the storekeeper was not well acquainted with all the problems of running a store He lacked training and experience He did not have enough money to begin with Sometimes he located his store where there were not enough customers to keep it going Sometimes he sold too many things on credit and did not insist that his customers pay him when they agreed to do so There were other reasons, too, but the main one was that the owner did not know enough about running a store to make a success of it You ought to keep that in mind

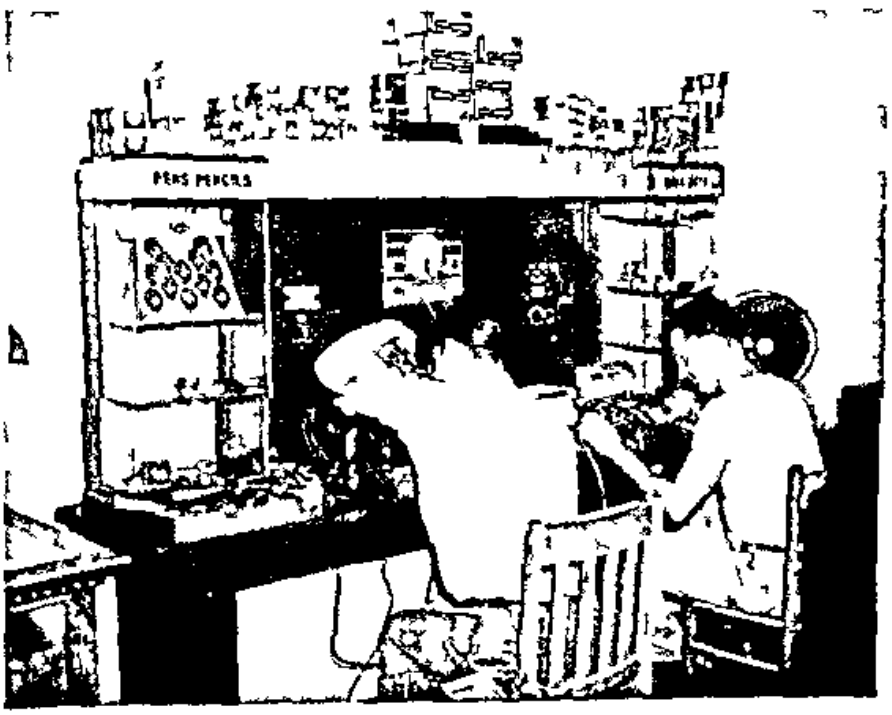
Many people who have the ability to own a store and run it successfully, never do so simply because they have not studied such a venture carefully The first step in this direction is to consider what type of store you want to own You should open a store which can offer for sale what people need and want and are willing to buy from you Remember you are to be the purchasing agent of the people who live near your store You must know what they want or your store too will disappear in a year or two and take all your investment with it

Here is a list of stores It is not complete but it will suggest to you some of the opportunities there are for small storekeepers

Some Popular Kinds of Small Stores

Boys Wear Shop	Newsstand and Smoke Shop
Drugstore	Photography Shop
Electrical Appliance Store	Sandwich Shop
Food Store	Sports Goods Store
Hardware Store	Sports Wear Shop
Jewelry Store	Beauty Shop
Men's Wear Shop	Blouse and Sweater Shop
Paint Shop	Children's Wear Shop
Radio Shop	Gift Shop
Shoe Store	Interior Decoration Shop
Bakery Shop	Knitting and Embroidery Shop
Book Store	Millinery Store
Candy Store	Misses Wear Shop
Ice Cream Parlor	Stationery Store
Leather Goods Store	
Women's Apparel Shop	

This does not mean that all these different kinds of stores can be successful where you are located You might agree that you could not be successful in a town of about five hundred people, if all you sold was candy at



Radio and Television Retailing

A radio and television repair shop offers fine opportunities for the mechanically minded young man. Most of these stores also sell accessories and some electrical appliances.



OWI photograph

It is extremely important for most retail shops to be close to the center of town This view of the main street of a small city is typical of many business districts over much of the world In such a location an attractive store becomes its own advertisement, just by being where many people pass and can see it. Many shop windows are changed from week to week so that the latest fashion is always on display

sixty cents a pound Yet in the larger cities where there are more people to buy this candy, there are many such stores making a profit

After you select the kind of store you would like to have there are many other things which you must know Running a store profitably is not so easy as you may think Here are some of the things you must do

1 *You must select a good location* A retail store can not go to its customers so the customers have to come to it Many customers go to the store which is most convenient That is particularly true of such stores as groceries, hardware and drugstores For other kinds of merchandise however most buyers like to shop around Examples are clothing accessories and furniture For such stores the best location would usually be the center of town, near other stores selling similar merchandise Selecting a good location is a very important matter

2 *You must prepare the store for business* After the location has been selected, a great deal of attention needs to be given to the building and to its interior so that people will be attracted to it and encouraged to go inside The character of the front windows and what they contain will indicate the character of the store Signs outside must be neat and clean The interior should be bright and shining The merchandise needs to be laid out carefully so that customers will know where to look for it with the least amount of trouble and delay All of this has to be done before the store can be opened for business

3 *You must buy your merchandise* There is an adage which says Goods well bought are half sold Most small retailers do not buy direct from manufacturers They buy most of their goods from neighboring wholesalers manufacturers agents brokers or other types of middle-men Since a retailer must resell his goods to a customer before he makes a profit he must really know what this customer needs and wants before he buys anything Otherwise he is apt to buy what the salesman wants to sell him That can be bad

4 *You must sell the merchandise which you buy* You are familiar with the selling of all kinds of goods Before you see it on the shelves, merchandise must be unpacked sorted priced and marked for sale If you have a good memory, it will help you very much in waiting on your customers for you

will know where each article is and can find it at once If a customer asks you for some thing which you do not have in your store you will not have to waste time looking through your stock to see whether it is there or not You can say at once that you do not have it You should know enough about your merchandise to know whether or not you can obtain the article your customer wants If you know that you can get it and that it will be profitable for you to do so you should tell your customer that you will be glad to get it for him

Pleasing your customer is one of the important points of selling Many successful retailers make a special study of selling Some courses in salesmanship are very helpful Whether or not you study such a course *you should remember that a customer will* come back to your store again and again if you have made him like you and trust you Otherwise he will do his best to buy what he wants at some other store

If you have clerks to wait upon your customers you will have to hire and train them You will have to see that they are helpful to the customers You will be able to make your clerks into much better salesmen if you are a good salesman yourself

In order to sell your merchandise you must find ways of bringing customers into your store In addition to having a good location an attractive store and things for sale that people want you may wish to bring in more customers by letting them know what you have for sale Advertising will help you do this You may advertise in the newspaper or over the radio Handbills are another useful way to advertise your store You may write the handbills yourself and even distribute them yourself but you will have to find a printer to print them for you

5 *You must make a profit* A retailer buys his goods at one price and sells them at another and higher price The difference between what he has paid for a product and the price he gets for it is called a *margin* This margin is very important If it is too high the product will be too expensive and nobody will buy it If the storekeeper always tries to make as big a margin as he can people *will soon come to think of his store as* very high priced and they may try to do their shopping elsewhere On the other hand the storekeeper can not afford to have his margin too low If he does he will soon go out of business He must make sure that his margin is large enough to pay the expenses of running his store He has to pay the rent on his building salaries to all who work for him and the interest on his loan if he has borrowed money from the bank The money which remains after all expenses have been paid is clear profit called net profit The storekeeper may be able to keep this money for himself to pay his living expenses and to use in any way he pleases But the good re-



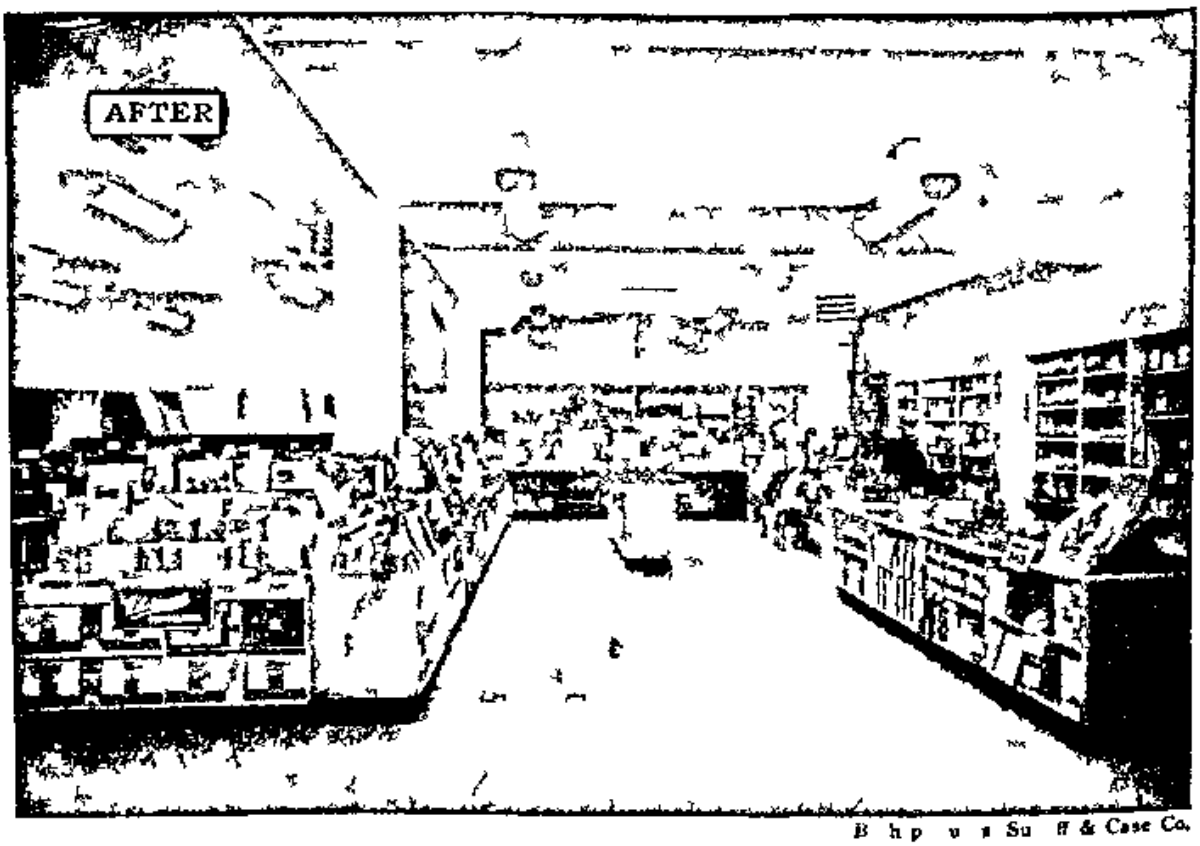
Young America

"The corner drugstore" a sight to many you have seen. Colorful posters draw a customer's eyes to the products they advertise; and the neat, well stocked shelves make it a treat that he is sure to be buying from you.

A DRUGSTORE IS GIVFN A NEW DRESS



One wond s h w he druggi can find any h ng n th se owd d and u tidy sh v s and show a s



B h p v s Su ff & Case Co.

A te red co ation he spa ous and p asan arrangemen of the same s ore w l attra t many n w cus omers.

tailer thinks twice before he fritters his prof its away

If he wants to build up his store he may put part of the profits back into the business He may use it to increase the size of his stock—that is he may buy a larger amount of merchandise so that he will have more to sell Or he may spend some of it on improv ing the appearance of his store perhaps buy ing a better display case or installing a bet ter kind of lighting He may think of any number of ways of spending his profits to make changes in his store In each case he must consider the change very carefully to be sure that the expenditure will prove worth while This is especially true if he is think- ing about spending his profits to enlarge his store If he is in too much of a hurry about making his store bigger and if he buys more stock than he can sell he will find himself in all sorts of difficulties One word for this kind of trouble is overexpansion In plain ordinary language, he has grown too big for his boots

6 *You must keep records* Today the re tailer must know how to keep books He has to keep track of what he buys of what he sells and of what he owes If he sells on credit he must set up an account for every credit customer and send him a monthly statement He must keep a careful record of all income and expenses so that he can re port on Social Security and make out his tax reports Record keeping is very impor tant One of the chief reasons for business failure is unwillingness or inability to keep an accurate record of all transactions every day, just as they happen

7 *You must keep a clean store* A retailer should be a good housekeeper He must keep his store clean wash the windows regularly sweep it every day have everything look fresh and new see that his clerks are neatly dressed and make the store so inviting that people will want to come back

Now if the store is a very small one the proprietor may have to do *all* of these things himself Then he will have to get to the store early in the morning and sweep out before he opens the store for business He must talk to the wholesale salesmen and at the same time, make sales to his customers At night after closing he must check his stock and decide what he needs to buy next make the proper entries in his record books write out checks to cover the bills which have come in and decide what he is going to do tomor row other than routine work Only then can he go home He can not be a clock watcher



Ewing Galloway

These crowded windows and ugly signs do nothing to make this men s wear store attractive Its only appeal lies in the promise of a possible bargain to be had.

Now let us summarize the opportunities and responsibilities the favorable ideas and the unfavorable ideas concerning your own small retail store Here are some of the fa vorable points

1 The business will be yours and you will be the top man or woman in it

2 *If you have a new idea you can put it* to work right away and if it proves to be a bad one you can drop it just as quickly

3 You will manage your own time and capital and any profits you make will be yours to use as you see fit

4 In the early months of your store some of the members of your family may help you so that you will not need to spend your in come in hiring help

5 As your business expands you will be come an important member of your commu nity You will be able to help others less for tunate at the moment than yourself A great deal of pride and self satisfaction can come from your own hard work and success

But before you reach any conclusion please think about the points on the other side

1 When you are boss and owner of a re- tail store you are responsible not only to yourself and your family, but to your em ployees, creditors and customers You are the one who has to meet the payroll every Saturday and who has to find the interest for



International News Photos

Buyers for dress shops often visit wholesale houses to select their merchandise Here we see two models displaying evening gowns for the approval of buyers In addition to selecting attractive styles the buyer must check quality and price. And more important, he must know just what type of dress his customers will want to buy

that loan at the bank every month

2 Every final decision is up to you No matter what the question is you will have to decide what to do in every instance scores of times a day

3 No retail store will run smoothly even after it has been open for a long time A hundred and one things come up unexpectedly You must be able to adjust yourself and your business to constantly changing conditions because many of these problems will be outside your own control

4 You will have to work hard probably harder than you have ever worked before For instance in many cities retail grocers must be up and at the fresh produce market by five o clock each morning No matter how you feel the store must be open six days a week from a certain hour to a certain hour Good customers may want you to get things for them after hours Saturday is often the busiest day and there are no vacations around Easter or Christmas and no entire summer off to go to the shore or the mountains or the lake or to take long trips

5 Even after your store has grown larger and you have several employees the chief responsibility is still yours day in and day out If you try to dodge the responsibility it will not be long before your creditors take your store away from you

If you still want to own and run a small store the next thing to do is check yourself and determine some of the things you need for success It will pay you well to develop those which you lack

1 What experience do you have? Boys have a greater opportunity to gain experience than girls have because they can deliver packages open boxes shelve stocks and do many things about a store even before they can wait upon the customers But girls can gain experience too as checkers in grocery stores or as typists and clerks in department dry goods and other larger types of stores

2 School work in arithmetic writing spelling and English grammar will give you

important tools for running your store Typing manual training and public speaking will be a great help to you Every store owner should have some training in civics retailing and salesmanship Remember experience and training are important and there is no substitute for them

3 Do you like to be with people and work with people? If you would rather curl up in the corner with a book or go about exploring the out-of doors alone you should forget about running a retail store You will have to work with people every minute of the day

4 Are you willing to work hard long hours? Owning a business is really hard work and you must keep at it every business day of the year Every year This is a very important point

5 Do you have imagination and initiative? It is not enough to have a lot of new ideas Your ideas must be practical ones which will work and produce more profits for you You will have to make your own decisions You will have to plan ahead for your store not just wait until things happen and then decide what to do If you do not like to think things out for yourself and if you are slow in reaching a decision do not plan to own a store

6 Do you save your money or spend it as fast as you get it? To run a store well you have to save so that you can buy more merchandise in season or be ready for a bargain or give your store a fresh coat of paint when it needs it You must have money on hand when you want it or your competitors will take away your trade

7 Are you as good as your word? Of course you realize that you must be honest careful and ready to help others A retailer carries on much of his business by word of mouth that is by promising to do something at a future time If he fails to do what he has promised to do he will not be in business very long In the same way if he is careless and opens his store each morning when it is convenient to him or pays his bills only when he happens to feel like it pretty soon he will not have any business at all Possibly

F lomena a Hobby Nu ley N J



The young lady who owns a gift shop has the joy of selling wares that are novel and different—pottery baskets toys and hundreds of other bright and exciting articles



the most important point of all is liking to help other people If he is selfish and always thinks of himself first he is not going to be a good retailer

Now if you become a retailer a good one what rewards are there for you? There are a great many as any successful retailer will tell you You have the satisfaction of bring ing from the ends of the earth goods and services which the people in your community need and will use You help these people live a pleasanter happier life You help many of them in their emergencies You help them with their problems In doing these things you will make many friends who know you are a fine person and who value your friend ship

Second you will be a very important part of the world of business No manufacturer could keep his machines go ng a week were it not for the retail store which tells him what the customers want and which sees that the custon ers get it after it is manufactured Without the retailer business would jerk to a standstill Our whole way of living would have to be made over

Th rd a good reta ler has the joy of bring ing things and people together and creating a business a successful business Just as you mix together the ingred ents that make good fudge so the successful reta ler mixes an empty store some merchandise and knowl edge and ends up with a thriving business If he has too large a store the wrong kinds of merchand se or too little knowledge he is a failure There is great satisfaction when h s creative ability results in a sound profitable business There is a healthy pride which gives a glow to everyday living in seeing one s hard work and effort bear fruit Keep ing an attractive store sometimes brings out artistic talents the owner did not know he had

Fourth a successful retailer can do a great deal of good in his community by sup porting everything in it which will make that town a better place If you check the mem bership of the luncheon clubs the names on the boards of directors of the chamber of commerce the local hospital county fair churches and other community activities you will find the names of many retailers You will find storekeepers holding civic of fice on the city council and school board Many storekeepers are able to give these community responsibilities the same honest hard working support that they have given to their own businesses In doing so they aga n have the satisfaction of helping others without seeking any d rect return

Finally a successful retailer receives a reward for his labors in the form of the net profit which his store produces It will pro vide for h s family and himself many of the things in life which they hold valuable such as a good home vacations college education for his children and enough money so that he can retire later on The rewards of a suc cessful retailer are the rewards wh ch any man or woman gains from work for wh ch he is f tted for which there is a demand and in which he finds true satisfaction



Pub sher s Weekly

A comfo table and well decorated bookshop where customers may browse at leisure is a friendly store to own



Plants turn the sun's energy into food, and then we eat the plants to give us energy for play and work.

Our Debt to the SUN

By Morris Meister

SOME day there no longer will be any coal or oil for man to use, how soon can not be predicted exactly, there are differences of opinion among scientists Yet that time will surely come—one thousand, ten thousand, or perhaps one hundred thousand years from now—if we continue using fuel at the present rate How, then will man do the world's work? Trains and steamships would stop, since they require coal or oil A great many of the machines operated by electricity would cease to turn because most electric generators are driven by engines requiring steam or oil The few that are driven by water turbines would be hardly sufficient for modern purposes Electric cells and batteries can not do the work The automobile would be motionless No airplane could leave the ground Many homes would be cold and most factories would be silent Of course, we should still have the wind and flowing water, such wood as could be had from forests and the fuel that can be manufactured from plants Yet modern civilization could not get along on these sources of power alone

Coal and oil are the remains of certain plants and tiny animals which lived millions of years ago These ancient living things used sunshine, just as plants and animals do today Each time we burn a lump of coal, and each time we "step on the gas" we are using up the energy of ancient sunshine The sun is still shining and its energy is being used by living things that could some day form great deposits of coal and oil But we can not afford to wait for that slow process A way must somehow be found for putting to use more of the present day sunshine, or else we must find sources of energy that do not depend upon the sun Scientists are beginning to make progress in both directions Let us consider first what might be done to harness the sun for doing some of the work of the world

Day after day, the sun pours out vast amounts of energy It is estimated that the earth's surface receives from the sun each year the equivalent of many thousand horse power for every square mile If we could make good use of the energy absorbed by even a dozen square miles the threat of a coal and oil famine could be banished forever In the last one hundred years, the minds of many men have been busy trying to solve this problem

In the year 1866 Emperor Napoleon III of France visited the shop of a French inventor named August Mouchot In the yard of the shop stood a large, cone shaped object resembling a huge lampshade The opening of the cone was directed toward the sun its inside was lined with a thin film of silver At the small end of the cone lay a small copper box, blackened on the inside The Emperor was told that this curious device was a solar engine, that is, a sun engine The rays of the sun were gathered by the cone and reflected by the silver lining down upon the small copper box which contained water The heat caused the water to boil So impressed was the Emperor that he urged his government to support and finance the building of many of these solar engines Yet, the scheme was not very successful

After Mouchot came several other inventors of sun engines All of them used one or more of three important arrangements for collecting the sun's rays—the conical mirror, the cylindrical reflector, and the hot box—an airtight box, black inside, and covered

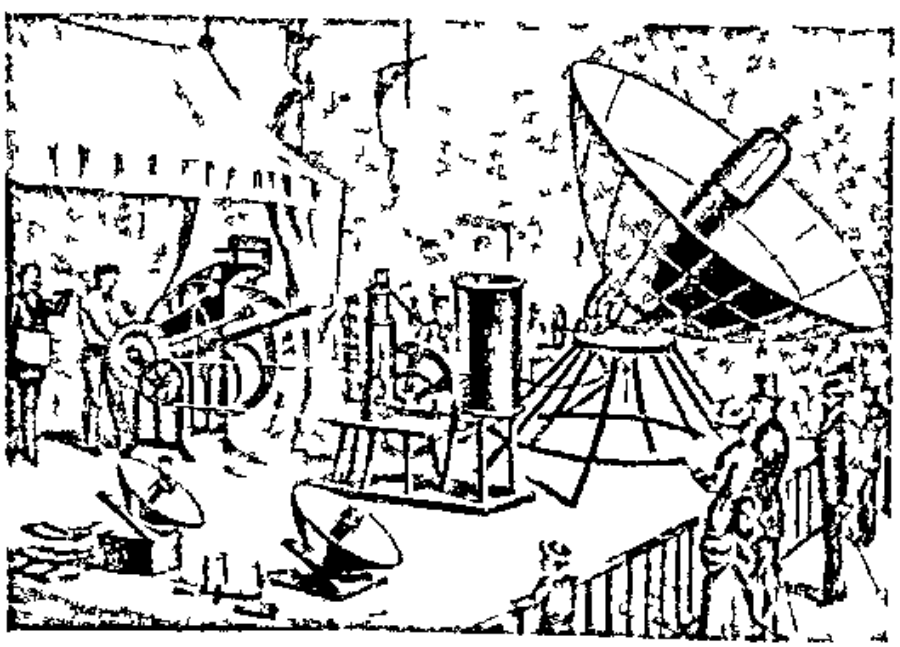
with two layers of glass Heat waves pass through glass and black absorbs heat

A solar engine was set up in the Arizona desert in 1904 It used a cone shaped reflector and weighed about 8 300 pounds Seven hundred square feet of sunshine was collected which boiled water into steam which in turn operated an engine In 1913 a solar engine erected in Egypt gathered sunshine falling on an area of 13 000 square feet This engine developed about 55 horse power every hour However the machine proved costly and could not be kept running easily

One of the most workable solar engines ever built stands atop Mount Wilson in California It consists of a large cylindrical aluminum mirror that is free to rotate about an axis parallel to that of the earth s A clock mechanism causes the mirror to follow the apparent motion of the sun The rays of the sun are focused on three continuously connected oil filled glass tubes about six feet long Each of these tubes is covered with two other tubes which enclose a vacuum so that very little heat is lost by the oil As the oil gets warm it rises and soon a circulation is set up from the oil tubes to a storage tank and from the tank to the tubes As this continues in the sunshine the oil gets warmer and warmer sometimes reaching a temperature of about 390 degrees Fahrenheit—which is hot enough to bake bread cook food or boil water into steam for power purposes Seven hours of sunshine a day are enough to keep the machine going day and night at about 212° F This machine is sometimes called a sun cooker

There have been other efforts to make use of direct sunshine One of the most interesting is to use the sun s heat to produce cold You are familiar with the type of kitchen refrigerator which is operated by a gas flame The heat of this flame evaporates a special liquid called a refrigerant The evaporated refrigerant (now a gas) is then compressed When the gas is allowed to expand again rapidly it produces a cooling effect which freezes the ice cubes and keeps the food cold Similarly the sun s heat pouring down upon the roof of a tropical bungalow can be made to evaporate a refrigerant which can then keep the air inside the bungalow cool

Another scheme for making direct use of the sun s energy is to allow it to heat the junction of two pieces of different metals When this is done an electric current begins to flow in the metals The current though small in amount can ring a bell light a lamp or run a motor The metal junctions are called *thermocouples* Some years ago a German scientist by using several thermocouples succeeded in keeping an electric lamp lit by sunshine for several months A French scientist has proposed a plan for connecting together half a million thermocouples The junctions would all be exposed to the sun and the ends would be embedded in concrete so as to keep them at a lower temperature In this way huge amounts of electricity would be obtained Unfortunately the cost of building the arrangement would be too great as long as there is still enough cheap coal and oil available for generating all the electricity we need



Mouchot s solar engine which we describe in the text Here it is made to run a small printing press seen at the left

The most likely use of direct sunshine in the future is the opening up of desert areas These regions have steady sunshine and they are usually far from coal and oil If the sun s energy can be caught by some form of solar engine it can be changed either into the heat energy of steam or into electrical en

ergy With energy available many such deserts can be irrigated and transformed into fertile farms and gardens Excess electrical energy can be sent out to other regions which do not enjoy such intense and steady sunshine

We spoke of finding sources of energy that do not depend on the sun Men have dreamed for years of using the power of the tides and successful experiments have been made The greatest field for power research today is within the atom Ceaseless activity goes on inside the atom and an enormous amount of energy is occasionally developed accidentally when atomic particles collide Some atoms as you know are breaking up and giving off (radiating) energy Radium is one of these elements whose atoms are breaking up Other atoms can be made to break up We call the process atom smashing For some years atom smashing has been going on in laboratories all over the world Not until 1945 was a way found to employ the energy thus created (See Atoms and Atom Power) The use for atom power so far has been for destruction When we can learn how to harness the enormous energy that is now locked within the atom we shall have all the heat and mechanical power all the electric power and light that we need But even then we shall be dependent upon the sun for other things

THE ENORMOUS HEAT OF THE SUN OUR SOURCE OF ENERGY

The sun is a star some 93 000 000 miles away It consists of many different layers of gases at a very high temperature The temperature of the surface of the sun is estimated at about 11 000 degrees Fahrenheit This is twice as hot as anything man has been able to devise The sun's interior may be ten times hotter At these temperatures the molecules in matter break down into the smaller particles called atoms The atoms themselves undergo change sending out rays of light and heat Though these rays travel for 93 000 000 miles before they reach the earth they can cause a pretty severe sunburn in less than fifteen minutes

The sun is the basis of our existence and the source of all our usable energy There are several forms of energy light heat mechanical electrical and chemical Each form can be changed into another The starting point for most of these changes however is the light energy which pours down from the sun You have probably tried to concentrate the light rays of the sun with a magnifying glass or a mirror The light changes into heat which can boil water into steam The steam can turn a small dynamo Thus the heat energy is changed into mechanical energy The dynamo generates electricity showing how mechanical energy can be changed into electrical energy Electricity can decompose water into hydrogen and oxygen This is a change from electrical to chemical energy Aside from certain kinds of chemical energy and the energy within the atoms of matter all means for carrying on life activities come to us from the sun

HOW MAN USES HEAT ENERGY TO GET ELECTRICAL ENERGY

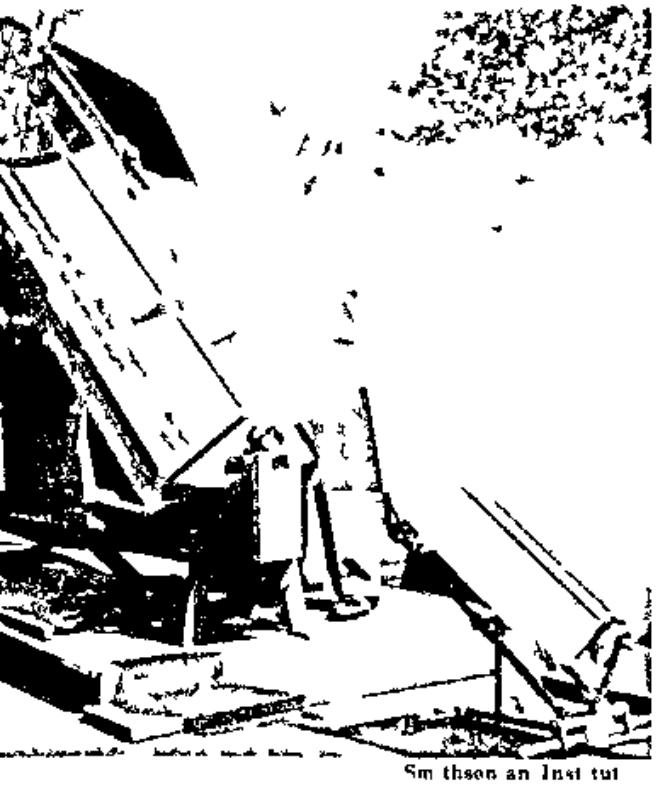
The rays of the sun cause the water of lakes rivers and oceans to evaporate into the air Later the air moisture condenses and falls as rain snow or hail This fills the rivers which can be dammed so as to store water at a height When allowed to fall and press against the blades of a turbine or water wheel the mechanical energy is changed to electrical energy

The sun warms the land and the water but water heats up more slowly than land and then holds the heat for a longer time When the land is warmer (during the day) the air over it rises letting in the cooler sea breezes When the sea is warmer (during the night) the air over it rises letting the cooler land air blow toward the sea

You know that the earth is tilted with respect to its path around the sun You know that because of this tilt certain regions of the earth receive the direct and concentrated rays of the sun while other regions receive rays that are slanting and spread thinly over the area The summer season comes to those parts of the earth which are bathed by direct sunshine, and the winter season arrives where a section of the earth receives the rays slantwise Regions near the earth's Equator receive rays that are close to perpendicular during the entire trip Hence such regions enjoy hot summer weather all the time

Areas near the Poles never receive direct rays and have periods when they receive no sunshine So polar regions are always cold

The fact that certain areas are always warm and others always cold sets up huge movements of the air As the earth spins these air movements are caused to swerve and give rise to the well known wind belts It is in these moving air masses that weather conditions start In a sense then the sun is responsible for our weather It is the sun's energy which heats the land heats the air



Smithsonian Institution

Another kind of solar engine—the flash boiler

and causes the air to rise and which evaporates the water into the air Even the electric storms are due to the sun because evaporation produces electrical charges in the moisture particles and some of the sun s rays help to increase these charges We owe to the sun our seasons, our climate and our weather

Light can stimulate the retina of the eye The eye lens forms an image on the retina and the brain interprets the stimulus as the picture which we see Certain chemicals are also affected by light A piece of photographic film contains small grains of a chemical called silver bromide This silver bromide is colorless and opaque (Light can not pass through it) When light strikes the film the molecules of silver bromide are changed so as to leave a black silver deposit This is what happens when a camera lens forms an image on the film Even when you take a snapshot, the momentary flash of light produces an effect on the silver bromide The effect is later continued when the film is developed and the picture printed from the negative

Contained in sunlight is a kind of ray called *ultraviolet* This ultraviolet light is colorless and invisible to our eyes yet it makes its presence known and felt It is very penetrating and is responsible for sunburn This can be observed in the effects produced by the mercury vapor lamp which is a rich source of ultraviolet light While direct sunlight can produce a burn in about fifteen minutes, a mercury lamp can cause a similar, or even more serious burn in two or three minutes The nature of skin burning or tanning is quite interesting The action of sunlight on the skin or of the ultraviolet rays contained in sunlight, is to produce a substance called vitamin D on the surface of the skin The same vitamin D can be produced in foods such as milk or oils and fats by exposing them to ultraviolet light The process is called irradiation As you know, vitamin D is necessary if our bones are to grow strong and it is most important to general good health

It has been shown that ordinary window glass allows most of the sun s light to pass but blocks the rays of ultraviolet That is why we are warmed but not burned by the sun in a glassed in porch or sun room There are special types of glass which permit the passage of the ultraviolet rays There is room for much further study and improvement in this field

Every leaf, every blade of grass enjoys a secret which the wisest scientist does not know For years scientists have been trying to find out how plants make use of sunshine We know that water and minerals come up from the soil through the roots and stem of plants to the leaves We know, too, that there are millions of openings on the under surfaces of leaves which let in air containing carbon dioxide Then in the presence of a green material called chlorophyl and while the sun sends down its rays, a chemical action takes place in the cells of the leaves As a result of this action, carbohydrates are formed and oxygen is released to the air Carbohydrates—starches and sugars are examples of carbohydrates—are the food which the plant makes for its own use Then we eat the plants Thus corn, wheat, fruits and vegetables are the products which plants manufacture with the help of sunshine They are the food for all animal life, including man Yet we do not know all we should like to know about the chemical process in the leaf which means so much to our lives

A GREAT RIDDLE STILL TO BE SOLVED—THE SECRET OF PHOTOSYNTHESIS

Who will solve this mystery and learn the secret of *photosynthesis*, as the chemical process is called? The scientist who succeeds will relieve the farmer of many heavy tasks and uncertainties He will abolish forever the fear of exhausting the supply of coal and oil He will have found a way of duplicating nature's own solar engine—the leaf

It is estimated that one hour of sunshine falling upon a square yard of leaf surface results in the manufacture of about one gram

of carbohydrates No wonder each plant al ways turns its leaves so that they catch as much direct sunshine as possible! In an acre of plants there are about two acres of leaf surface During a summer s growth a wheat field may take from the air about eleven tons of carbon dioxide and with the help of sun energy it will manufacture about seven tons of wheat

Several scientists have already been able to duplicate the process of photosynthesis on a small scale in the laboratory It is as yet too costly for large scale manufacture Many are studying the substance chloro phyl whose presence is essential to the proc ess In the Boyce Thompson Laboratory for Plant Research, at Yonkers New York some very interesting experiments are now in progress While the plant s secret is not yet discovered, some strange results have been obtained in an effort to change and control the growth of plants

Marine plant life is also affected by the light and heat of the sun In the oceans there exists a kind of one celled plant called the diatom Diatoms are bacteria of a sort which with the help of sunshine can pro duce the starch needed for their growth Small marine animals feed on the diatoms Larger fish feed on the smaller ones and so on Thus the sun maintains life in the oceans

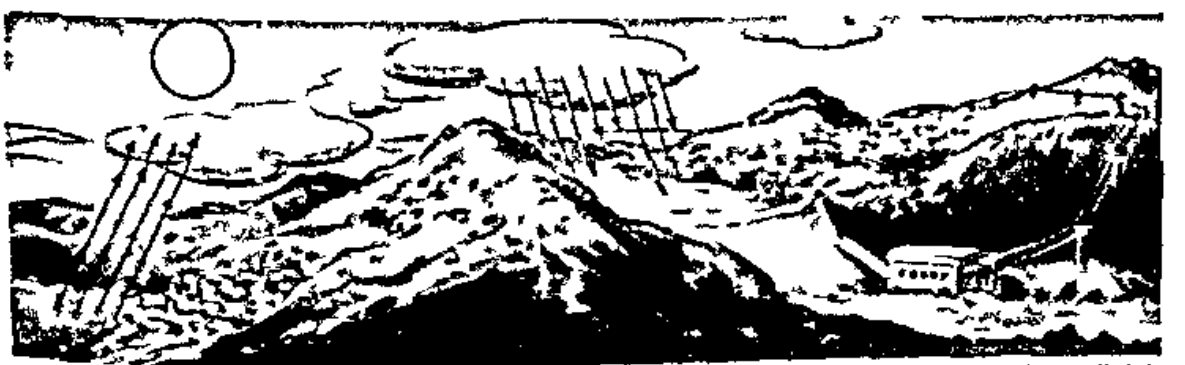
The heat of the sun also affects all animal life In the winter time in the Northern Hemisphere the sun is closest to the earth However since the sun s rays at this time reach us slantwise and not perpendicularly, little heat can be gathered This absence of heat and the decrease in amount of sunlight (since the days are short) causes many ani mals to hibernate that is to go into a sleepy state for the winter Snakes lizards frogs, most wild bears ants and squirrels retire for the winter If it were not necessary to come out occasionally for food it is likely that many animals would scarcely be seen during the winter months As the earth revolves about the sun and spring arrives the ani mals come out of their partial sleep They become active Everywhere on the earth ani mals tend to follow the sun This is not just accidental It is necessary for the preserva tion of their lives

It is sometimes asked how long life could exist without the sun Would life suddenly cease or would there be a gradual decay? As you know in the far north there is an al most total lack of sunlight for about six months Does life cease during that time to be revived with the coming of the sun? No enough energy is stored away during the dark period to maintain the necessities of life Animals hibernate and become dormant Man needs more than just food and shelter He can not afford to hibernate Life must go on

Should the sun fail to make an appearance for a single year the result would be ruinous Plant life as we know it would vanish and animal life would soon follow

Is there a substitute for the sun? Can an artificial sun be created? The nearest thing to an artificial sun is artificial ultraviolet light However it requires electricity to op- erate the mercury vapor lamps and electric ity is dependent upon the sun

Our debt to the sun is one that can not be repaid All our lives we are indebted to the sun for food, clothing and shelter There is only one thing we can do to repay in part this great debt We can practice *conserva tion* This means saving and not wasting It is true that the sun s energy is apparently endless yet we must learn to take all we need and yet leave some for succeeding genera tions In this sense conservation means care- ful and purposeful use Only in this way can we repay partially our debt to the sun



How sun and water produce power The sun draws water vapor up from the river to form in clouds. Chilled in passing over mountains, the water vapor condenses and falls as rain into the reservoir Water falling from the dam turns a turbine in the power house The turbine causes a dynamo to generate electricity

HIGH SCHOOL

TEACHING

AS A CAREER

By Lloyd Shaw

Superintendent

Cheyenne Mountain Schools



Philip Gendreau N Y

Alert looking students like these make teaching a joy

WHEN I was a very young teacher I knew a great high school teacher of Latin and Greek I visited his home one day and there I found to my astonishment that most of the books in his library were in still another foreign language When I exclaimed he told me something which I have never forgotten

The trouble with me he said is that I love everything When I see a miller at work I want to be a miller And when I see a stonemason I want to know how to cut and lay a beautiful wall

And that is why he was a great teacher Like this wise man you must always have many interests that you enjoy sharing with young people Never lose your enthusiasm for it will help you to make your classes worth while and a great deal of fun besides

The good high school teacher likes to play with ideas and to talk them over with his pupils This sharing of ideas is one of the greatest joys of teaching There is all the wonder of science all the new discoveries that are constantly being made And there is government! These are days brimful of drama To become aware of the meaning behind the drama to share the awareness with those to whom it will mean most—that is a thrilling experience In literature and the arts there lies another vast world of ideas When you try to explain them to your pupils you will have the creative joy of playing with great ideas in words of your own

Good times out-of-doors can have a great deal to do with teaching high school For instance do you like to go camping? Almost every boy and girl enjoys the stream the campfire and the open sky Or fishing? That is a splendid sport What marvelous things there are to do! Hiking and swimming and horseback riding skiing and skating and other winter sports You need not give up any of these good times if you teach high school boys and girls This is a point I want you to understand The good high school teacher shares as many activities as he can with his pupils

Teaching high school is a dull business if all you do is lay out a few pages of dry text to grind through each day You will have a weary time if you try to make each year's work exactly like that of the year before If you allow your subject matter to become old and set your students will have no zest for learning and you will fail

But the more you enjoy your life as a teacher the easier it will be for you to keep your courses fresh and new and vital

Sharing your ideas and good times with your pupils is fun of course but it is also very important for it will help you to understand the boys and girls whom you are teaching When you know what interests them you will be able to arouse their enthusiasm as naturally as you breathe

A high school teacher is off to a good start if high school is the one kind of school where he wants most of all to be It may be the right place for you if you like one of your studies better than any other Suppose you like English so much that you would be perfectly happy teaching nothing but English If you would rather teach English than any other subject high school will give you the

opportunity you want, for in most high schools the teacher is a specialist You may be a mathematics teacher, for instance Or you may like science best Many high schools offer you the chance to specialize in your favorite branch of science so that you may be a chemistry teacher or a physics teacher If history appeals most to you, you can even choose the period you prefer and teach nothing but ancient history or English history or American history Many grade schools do not offer you the same opportunity to teach only *one subject*

You should also think about the ages of the boys and girls whom you are planning to teach You will fit into high school teaching best if you are happiest with high school students Before you come to a decision it will pay you to consider carefully all the grades and all the ages covering school children s range Which ages would you like best to teach?

Some teachers mostly women, prefer the youngest pupils—the primary grades or kindergarten Others—and this includes some men—prefer *the upper grades Many prefer* the junior high school with its attempts at being grown up Some like high school best of all, and I am one of these

At first I thought I would rather teach in a college To work with young college men and women would be a great satisfaction I was tempted, too by the greater dignity that seems to go with college teaching Here I had a little problem in what dignity really is That is *one kind of problem which you* will have to decide for yourself some day But I should like to tell you what I thought about it Dignity, I concluded should depend on how well you do your job and not on what job you do

College students are young adults and they have become more set in their thinking than high school boys and girls Now high school students are very young But their abilities and skills are approaching those of grownups and they are old enough to share much of their lives with you I knew that I would enjoy working with these young people *most of all and so I chose high school* I have loved it A high school teacher, if he will can have a perfectly glorious life

What kind of person should you be to make a success of high-school teaching? You will need good health and a sound strong body You will need a good mind and fine character—honest unselfish and well balanced If you are ambitious and wish to advance rapidly to one of the best teaching jobs you will need to acquire certain outstanding traits One of the most important of these is enthusiasm which we have al*ready discussed* Another is the habit of looking as well as possible Your pupils will admire you more if you do and so will your fellow teachers You must learn to be fair in every situation that comes up and never to favor one student above another You should be a good leader and a good friend as well It will be a great help to you too if you learn to speak well in public And you must not be afraid of the hard work you will have *to do, for it will not seem like work* if you learn to enjoy it



Courtesy Western Michigan College

Round the table discussion in an education course Learning to be a teacher is a lively enterprise



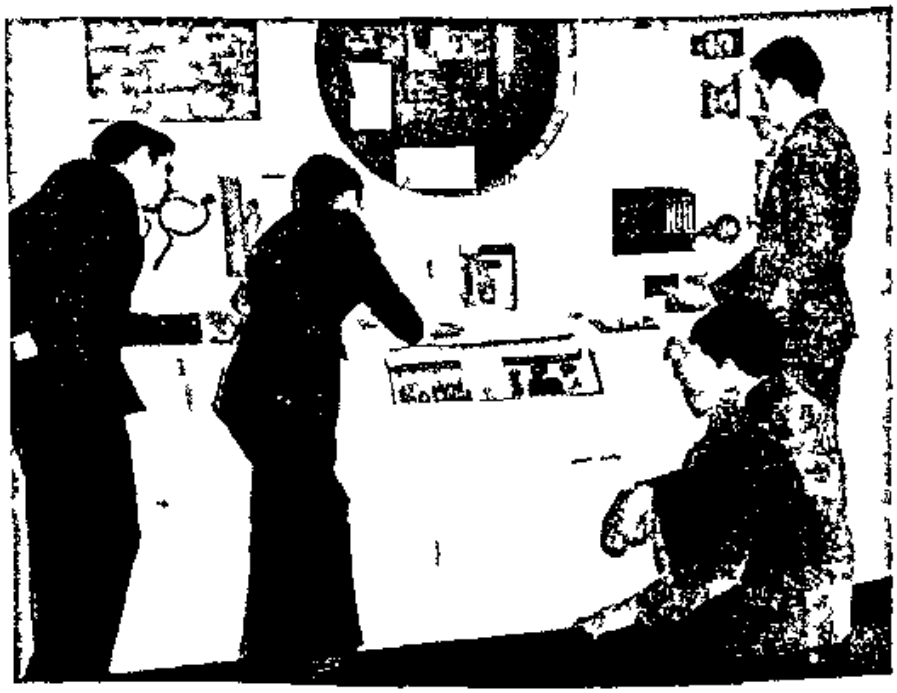
From All the Ch ldren

Learning Spanish the modern way by reading a newspaper published in that language

What education will you need to be a good h gh school teacher? Well the best start that you can make is to be a good student now What else? You must plan to have two kinds of education—general and special

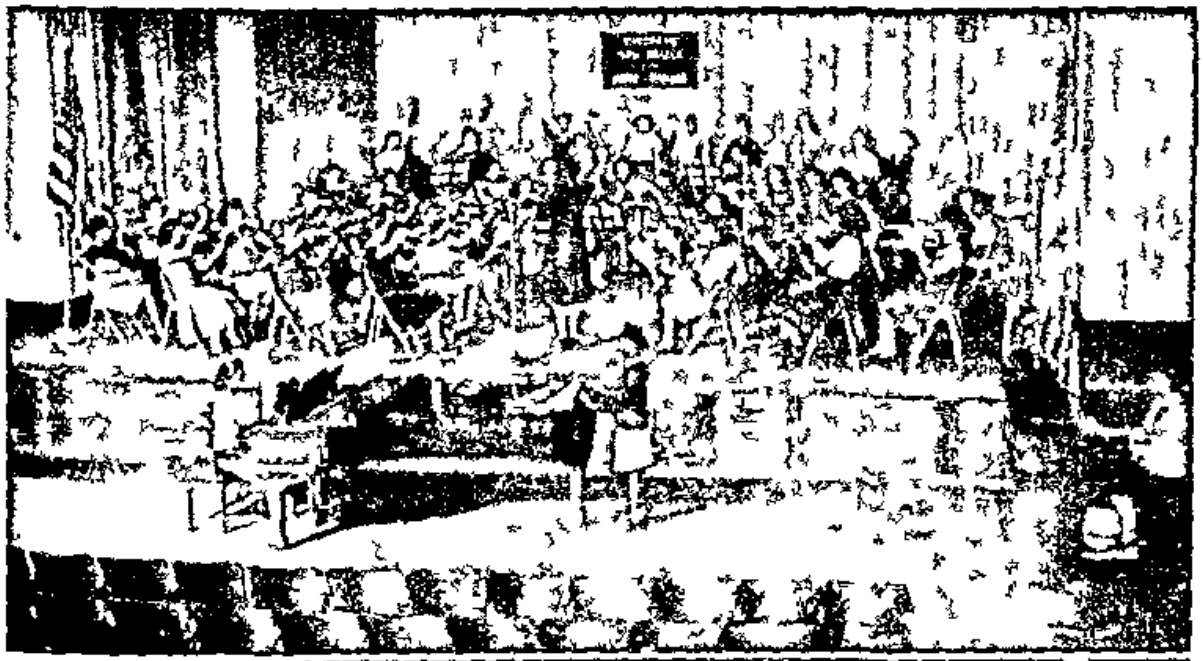
A general education includes college all four years of it at the least In accredited high schools a bachelor s degree is a stand ard requirement for teaching academic sub jects—that is such subjects as chemistry mathematics English or history High schools in some states require an add tional year of graduate work To be a really good h gh school teacher it would pay you to go on after you get your bachelor s degree and to study another year or two unt l you have taken enough work for your master s degree

Your special education will include two things—the subject which you are going to teach and also *how* to teach it You will have to take some courses in the history of teach ing Then you should study the best teach ing methods that you can find One of the things that you will study is the testing and measuring of students and their progress And you will learn about their curricula—that is the courses which your pupils will be studying You will even practice teach ng a little with special practice classes It is very important that you study teach ng where there are good facilities for you to teach students for then your first work with



Cou esy
R verdale Country School

A visit to the Museum of Science and Industry by a class in science



From All he Ch l n

Helping with the school o chestra brings the *teacher into happy rela* tion with students



Horn e Mann L ncoln Sc ool

"Putting on a play" de velops ski s and p o- vides thrills

children will take place under the gu dance of experts That is the best way for a be- g nner to learn to teach

It would not be a good idea for me to talk to you about methods of teach ng for many of these methods may have changed by the time you are ready to use them A great deal of experimenting is going on today in an at tempt to find better methods Right now there are more ideas on this subject than you can shake a stick at During the war all sorts of ways were used to teach the armed forces in a hurry and some of these new ways worked wonders Some to be sure did not Schools and teachers and teachers of teachers find all these new methods very ex citing They are bound to be of great help to you when you study th s subject

Where will you go to learn how to teach? Teachers college? Normal school? Or a spe cial department of education in a college or university? The best advice I can give you is make every effort to p ck the one that is best for you Your teachers will be glad to help you choose it and so will the principal of your school You will probably send for many catalogs and read them too before making your choice Remember that the chief thing you are after is to get the neces sary tools for your job and you can not be a good workman without good tools

You will also have to prepare yourself for

the subject you want to teach Suppose you plan to teach chemistry Then you will have to learn a great deal about the field of chem istry and also about all the other fields of sci ence that are related to it

All of these stud es are a part of your spe c al education Your general education will cover a great deal more ground Do you know why? Well imag ne that you are about to teach a class in chemistry on your very first day as a teacher The time has come for you to tell your pupils a little something about the subject. Wouldn t it be just too bad if you could not express yourself gram matically and forcefully? And if you knew nothing about the history of the world you could not possibly tell your pupils how the great subject of chemistry fits into that won derful story

Do you think your pupils will respect you if you know nothing about great books and great art and great music? I am afraid they will not They will be studying about these th ngs at the same time that they are study ing chemistry and they will expect you to know something about them Another thing that a good general education should teach you is to write fluently and well This skill will be very valuable to you both in the classroom and out of it

"What a job to learn all that you will say But you must not think of it as a job It s fun! And if I study a little of every thing you will say that will make me a Jack-of all trades But you will not have to worry about that because you are planning to become a good master of a very fine trade —teaching And you will master your spe cial subject as well The really wise man tries to know quite a little about many things and a great deal about some one thing That is what the good teacher must do

A TEACHER WITH A HOBBY IS A BETTER TEACHER

Things you learn outside of classes can make you a better teacher If you are mak ing airplane models you need not feel ashamed of yourself for wasting your time You can have all the hobbies you want And every game you learn to play well will make you a better teacher It would be a good idea for you to get a varsity letter if you can in football basketball or track for your stu dents will respect you more if they know you have made a college team

Learn to play a musical instrument and work until you can paint a good picture and you will have opened wide the doors into two very wonderful fields Act in plays and write them Travel the whole world over Perhaps you can not do all of these things but every one of them that you do will make you a better teacher

HOW MUCH MONEY MAY THE HIGH SCHOOL TEACHER EXPECT?

Now what will you be paid for all this preparation if you do become a good teach er? In some parts of the country only $100 to $150 a month A good mechanic can make more In other parts of the country and in the best schools you may make up to $300 or $400 a month but such jobs are not abundant

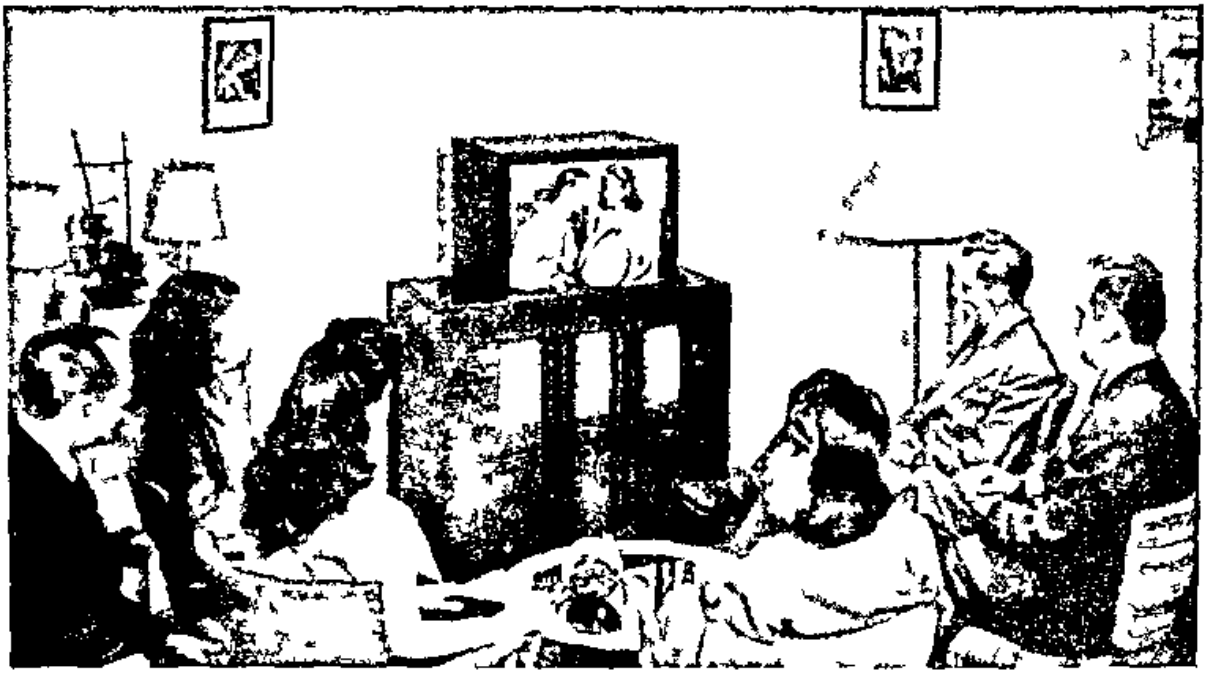
However people are beginning to realize the need for good high school teachers and so I think that the pay is soon going to be better Better teachers will surely get better pay I believe that high school teachers will soon merit the respect that used to be given only to college faculties in days gone by

The high school has and will keep on hav ing the fun of general education and of gen eral knowledge The high school teacher will have to become a wiser and wiser man or woman without ever losing the joy and en thusiasm of youth He will live a full and rounded life in an age that is becoming daily more limited and specialized

One of our young novelists once wrote When I took up writing the high school lost a mighty fine teacher That young nov elist has never written anything very famous since I always wondered why he did not stay in high school and write his novels in h s vacation periods Why didn t he keep his life full of the joy and adventure of youth? I think he could still be writing a fine novel every year or two if he had

For I don t know of a richer life if one cares to make it so than the life of a good high school teacher Not in money no But even there if he does a good job he will have little reason to complain People will ask him to do things outside of his regular school work and pay him well They will offer him more special prizes than he can accept And he can use his summers to increase his in come in any way he likes

It was a high school teacher who with his own enthusiasm and on his own two feet worked out the jungle route through Central America that the All American H ghway now follows while some of his teacher friends may have stayed at home all summer long We each order our own adventure ac cording to our dream



SCANNING THE TELEVISION HORIZON

By Peter C Goldmark

Columbia Broadcasting System

MORE has been discovered in the last four years that can now be appl ed to the improvement of televi sion than would ordinarily have been ach eved in ten or fif teen years of peacetime development This speedy progress of course was the result of having so many scientists and technicians at work together on the common job of win ning the war Under normal conditions these men would have been working separately each bound to a certain extent by the amount of money he was permitted to spend on research

The standard television picture before the war was made up of 525 horizontal lines that filled the screen from top to bottom These lines varying in l ght and shade were fine enough and close enough together to produce a reasonably clear picture Never theless they could be seen as lines much more easily than you can see the tiny dots that make up the pictures in this book The standard televis on screen was a little larger than this page turned sidewise. It was not large enough to be seen comfortably by more than one or two people at a time Larger screens meant more space between the l nes and the result of that was blurred pictures

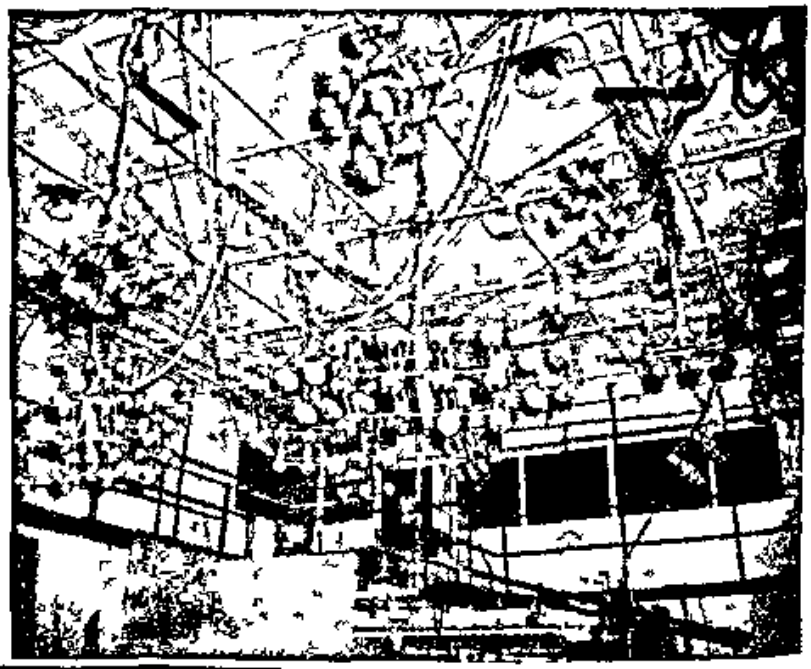


Above—An interested group enjoys a telecast on a home receiver Below—Part of the above receiver is cut away to show the intricate wiring

In the near future we shall have televi sion pictures that are made up of approxi mately 1 000 lines That means that the pic tures will contain about twice as much de-

tail of light and shade as the pictures we had before the war The lines will be so fine and drawn so closely together that your eye won t be able to detect them Moreover it will be possible to enlarge these pictures to at least eighteen inches in height before the lines become as widely separated as they

megacycles If these changes had come about under normal peacetime conditions they might have caused a great deal of trouble, for the sets and transmitters that were used in pre war television can not receive or send the new pictures Luckily from that point of view, the war put a stop to the manufac



Right—A television studio has many lights They are adjustable to give perfect illumination for programs



Left—A television camera is focused on the program At least two of these movable cameras are in action during all telecasting.

were in the smaller prewar screens The pictures, in short, will be as high in technical quality as the best home movies

To get these twice as good pictures, television has had to ' move upstairs ' in the radio spectrum, into the ultra high frequencies It has also had to increase its band widths of transmission from six to sixteen

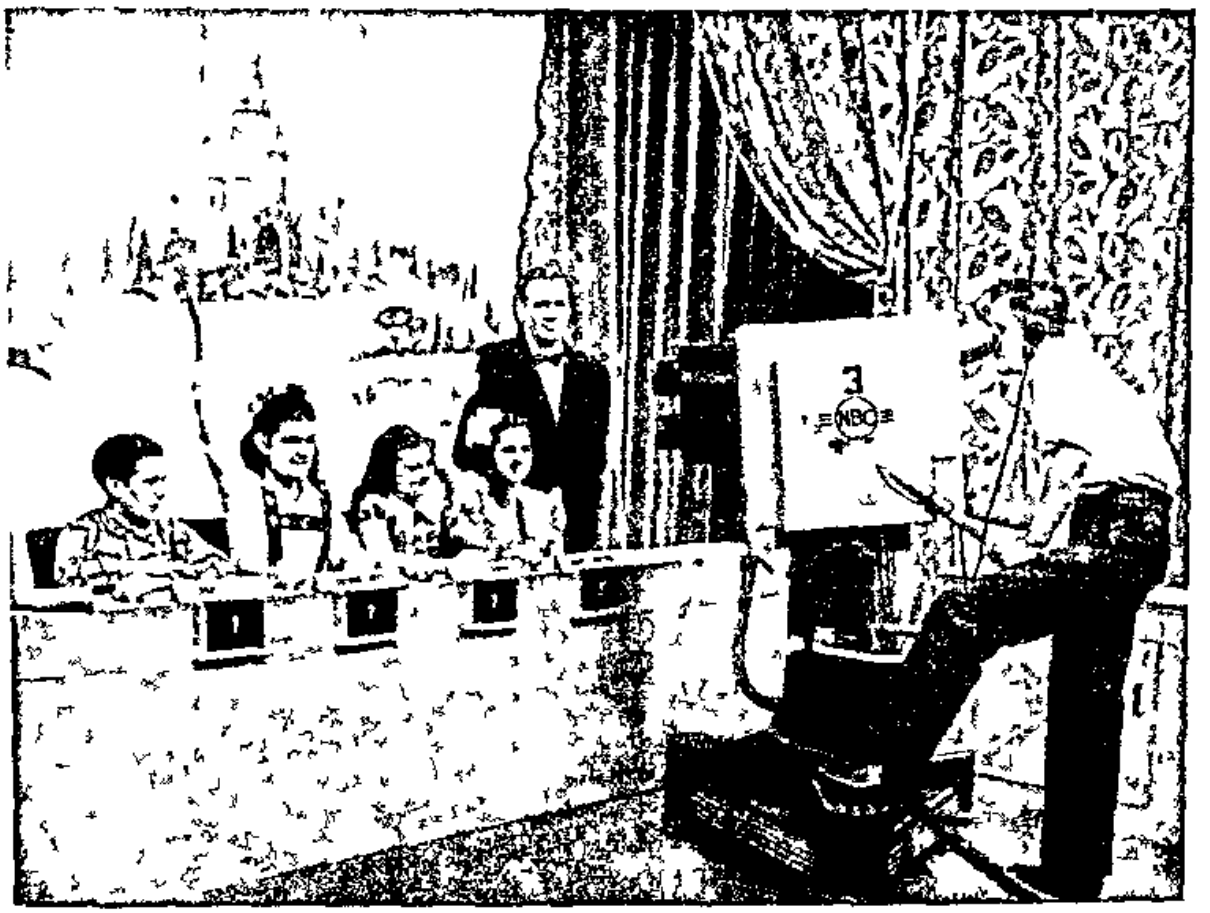
ture and size of all civilian television equipment As a result, only nine transmitters and fewer than 7,000 rapidly aging sets are being made obsolete through the discoveries of wartime electronic research

Television in full and natural color is also possible in the ultra high frequencies and wide bands of transmission, and will be dem-

onstrated at the same time as the improved black and white pictures Color television, contrary to popular belief, is not new It was successfully demonstrated by the Columbia Broadcasting System more than five years ago Among the relatively few people who saw them, a majority thought that the color pictures were superior to the black and white pictures of that time The new color pictures will be much better, comparable to the best technicolor or color illustrations in books and magazines

So far television has been seen in and around only a few scattered cities—New York Chicago, Los Angeles Philadelphia and Schenectady Television signals unlike ten years, as many people in the United States will be able to see television programs as can hear radio today

We do not yet know the exact method by which television networks will grow Two possibilities have already been tested and have proved practical One is to connect tele vision stations to each other by special cable called coaxial cable, just as radio stations are tied together by telephone wire Coaxial ca ble however is very expensive The thou sands of miles of it which would be needed for a nation wide network would cost many millions of dollars The other method is to erect relay stations at high points between cities whe e transmitters are located One



A typical studio television scene is caught as the camera focuses for a close-up of the "Telctruth" kid experts.

tadio, travel only as far from the transmit ter as the horizon That is why the few trans mitters now in operation are located as high as possible within the communities they serve—on top of skyscrapers in New York, on mountain tops near Schenectady and Los Angeles Eventually, of course, we shall have television networks Almost certainly within such station, for example has been built be tween Schenectady and New York and an other between New York and Washington Through these two relay points programs originating in one city can be picked up and broadcast to viewers in all three cities Coast to coast relaying however, would re quire nearly 100 such stations

A third and most promising possibility was recently announced by the Westinghouse Electric Corporation This is to install televis on transmitters in specially designed airplanes that will serve as relay stations

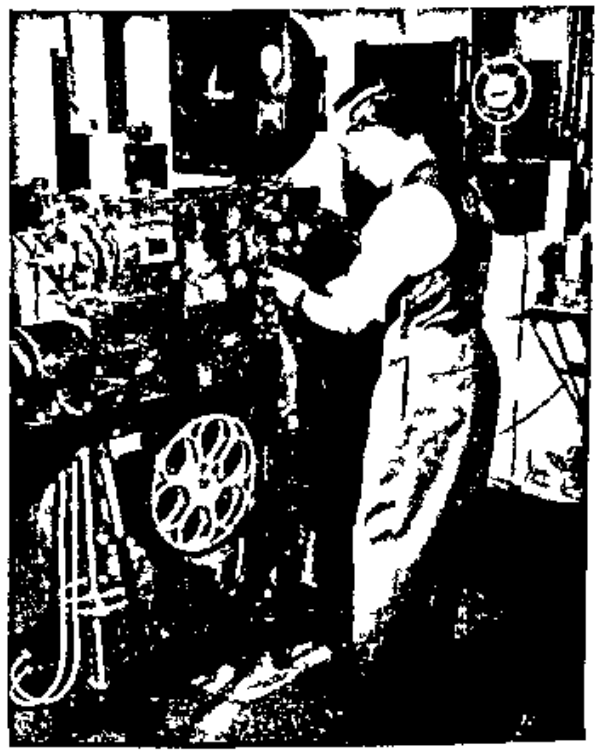
To understand what this new plan is all about you might think of a ball being thrown down a long line of people The first man in l ne tosses the ball The next man catches it and throws it along The idea is simply to receive it and send it on That is just what these special planes will do with televis on programs Enough of these planes flying many m les apart could send a televi sion program from coast to coast

Suppose a program is taking place in a television studio How does this program reach the first of the special planes? The program is fed into a small transmitter called a ground to plane transmitter and broadcast—or you might say telecast if you like that word better The program is then picked up by a ground link receiver in the plane Then it is fed into the plane s broadcast transmitter and rebroadcast The receiver in the next plane will p ck up the program and pass it along in the same manner

The plan is to have these airplanes fly in continuous relays at 30 000 feet over the areas they serve From high altitudes of course the horizon is greatly extended and a single transmitter could cover approximately 100 000 square miles An airplane flying at 30 000 feet over Pittsburgh for example could cover an area extend ng from Columbus, Ohio to Washington D C Th s stratovision method has yet to be tested



An engineer and his sound-control room instruments



Loading film into the projection camera for a retelecast over Station WNBT New York.

in practice and to be approved by government authorities

International television is still a long way ahead It probably will not be with us until after we have built a nation wide network and millions of us have television receivers in our homes However there is no doubt that television programs can be sent from nation to nation and across oceans There have in fact been occasions when television signals originating in England have been received on our Atlantic coast But these have always been under freakish circumstances and were poss ble only at frequencies under sixty megacycles

Television programs will soon be better than they have ever been Cameramen will not be as dependent on lighting conditions as they were before the war New pick up tubes have been developed by the Rad o Corporation of America that are extremely sensitive to ord nary light With these tubes and the new high frequency standards of transmiss on television can be used for outdoor events in any kind of weather and produce p ctures that are equal if not superior to the best newsreels

Some day regardless of where we live we shall be able to see in our homes most of the b g news events that occur in this country and many that take place abroad We shall



All photog aphs cour esy Nat onal Broadcas ng Company

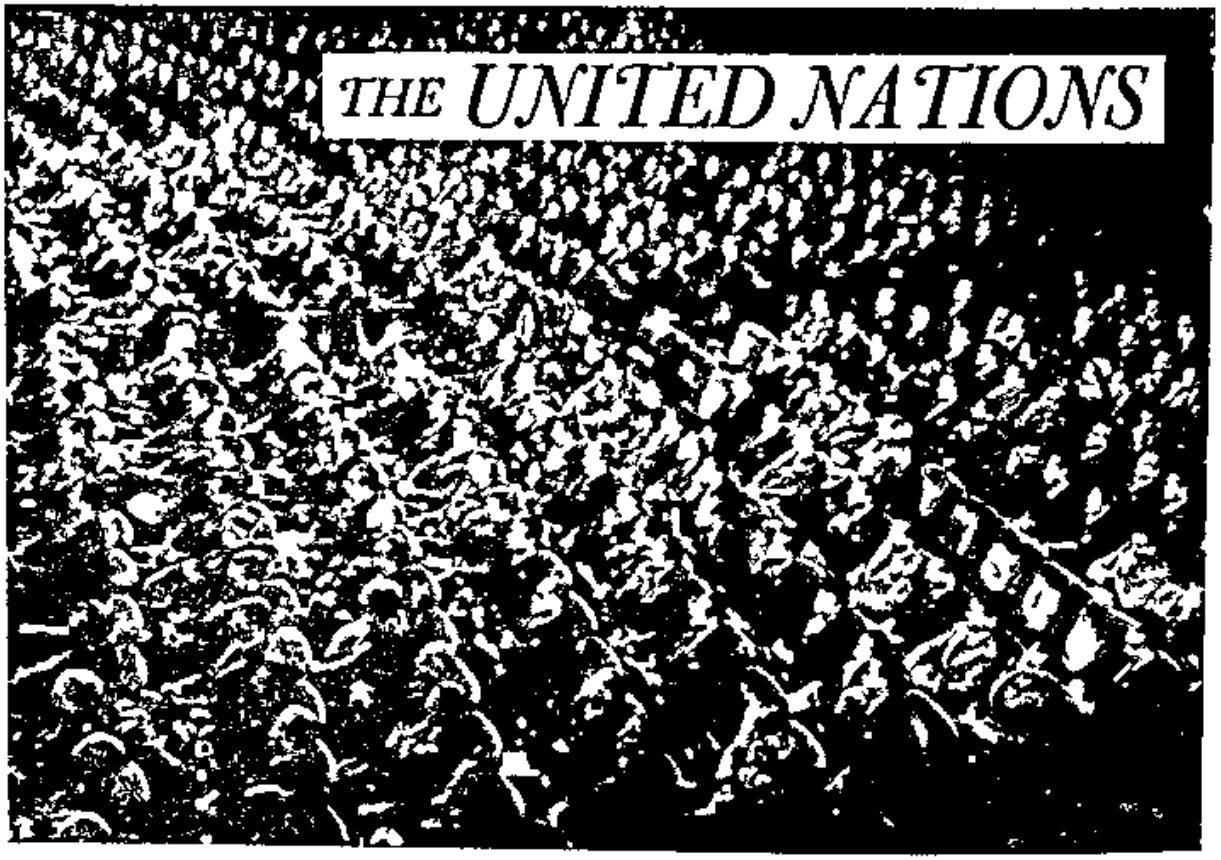
A Brooklyn Dodger baseball game is shown before the cameras in a telecast from Ebbets Field Brooklyn New York.

be able to follow national political cam paigns from nominations to inaugurations We shall be drawn closer to our own law makers and to the foremost men and women of other countries

The possibilities of television in education are very great In training millions of young men for various duties in the armed forces educators and psychologists learned a great deal about visual education Much of what they learned can be applied through television in our schools and colleges Much of what students now read in textbooks or hear in lectures can soon be seen in the classroom by means of television An art class in Nebraska or Alberta for example will be able to see great paintings in their true colors whether they hang in Washington's National Gallery or in New York s Metropolitan Museum or in The Art Gallery of Canada in Toronto Medical students will be able to watch a master surgeon operating in a hospital many miles away Small high schools will have famous college professors and scientists on their television faculties

It is generally assumed that television like radio will be widely used in advertising in the United States Broadcasters alone could not support the tremendous cost of network maintenance and programs Very little television advertising has yet been seen but many who have seen it speak of its ability to show how a product is used as well as to show its appearance This is especially true in the case of color television In time and if properly used television may become the most valuable form of advertising

Before the war television pictures and programs were not good enough to interest many people But now television will make a fresh start based on the improvements it has inherited from wartime research It is hoped that television will soon move forward to become a major American industry one that will engage the working hours of thousands and enrich the leisure hours of millions



THE UNITED NATIONS

By **Vera Micheles Dean**

Foreign Policy Association

EARLY in World War II, the nations that were ranged against the Axis became known as the United Nations As the war spread, more and more nations joined their ranks until, when the war ended with the unconditional surrender of Japan, the number of the United Nations had reached a total of more than fifty

All continents, all climates and all races of mankind are found among the United Nations Their people live in places as unalike as you can imagine, from the jungles of Africa to the great cities of western Europe and North America Some have great wealth and some are as poor as they can be These many millions of people make their living in all kinds of different ways

There is the same wide variety in their religious beliefs and in their ideas of government The United Nations include democracies and dictatorships, monarchies and republics There are states—such as ours—where the railroads and telephone lines and banks and mines are owned and managed by individuals or private corporations We call this system free enterprise In other states among the United Nations, the governments own and manage the banks and mines and railroads, and so on We call this system socialism

But all these many nations, so different from one another, had one compelling aim in common They were grimly determined to survive by defeating the efforts of Germany and Japan to enslave them

As long as they were faced with the pressing danger of defeat, the United Nations spared no effort to help each other against a common foe. Britain and the United States supplied naval power and so, to a lesser degree, did other countries—notably Norway and the Netherlands Britain and the United States furnished most of the air power Russia and the United States, with their great populations, gave the bulk of the land armies

The United States, because of its enormous industrial resources, was the arsenal of the United Nations It furnished a tremendous flood of munitions, guns, tanks, airplanes and other war equipment Britain and Canada, too, made war equipment for the United Nations Britain and Australia served as bases from which the campaigns were

launched that ended in the defeat of Germany and Japan Belgium, France, the Netherlands and Britain placed the raw materials of their colonies at the disposal of the United Nations Other vital raw materials were furnished by countries of Latin America Tin, for instance, was furnished by Bolivia, rubber, by Brazil Resistance groups in all European countries aided the common cause Such groups, because they worked in secret, were known as the Underground The brave men, women and children of the Underground prevented Hitler from establishing complete control over the Continent, and helped to prepare the way for Allied invasion In the Philippines, guerrillas, hidden from the Japanese, snatched at every chance to kill or sabotage the enemy Soldiers, sailors and airmen of the United Nations fought bravely side by side, some in the steaming jungles of Burma and on the Pacific Isles, some in the deserts of Africa and others in the hedgerows of Normandy On all the seven seas as well as in the air above all theaters of war, they proved their courage and their comradeship

FACED WITH THE DANGER OF DESTRUCTION MANY NATIONS FOUGHT AS ONE

In this common struggle the interests of the United Nations became closely interwoven People in danger of destruction have little time to think of national prestige or of saving face Americans, British, Canadians, Frenchmen and others fought against the Germans as one great united force under the command of an American leader, General Eisenhower Similarly, Americans, British, Chinese, Indians and others fought as one great force in southeast Asia under the command of a British leader, Admiral Lord Mountbatten

The United Nations pooled their resources of raw materials, food, manufactured goods and ships, and distributed these where they were most urgently needed This was an enormous task It was carried out through the Combined Boards in Washington, of which the United States and Britain were the most important members

Another tremendous task was that of working out together the strategic plan of the war This was done through the Combined Chiefs of Staff of the United States and Britain, who worked closely with the military leaders of the other United Nations Such remarkable team work, on so huge a scale, had never before been known Not one of the United Nations could have won the war alone It was team work that made it possible for them to defeat Germany and Japan

We all know, however, that military victory is not enough If the partnership built up by the United Nations in wartime should fall apart, the Germans and Japanese might recover their strength at some future date They might once more catch us off guard if we and our allies are no longer united How should we carry over into peacetime the cooperation we so effectively developed in time of war?

COULD THESE NATIONS WORK TOGETHER IN PEACE AS IN WAR?

This question was being studied by President Roosevelt and Prime Minister Churchill long before the war was over In order to find an answer to the question they, and other Allied leaders decided to create a number of international agencies in which the United Nations would begin to prepare for the enormous problems of peace In the grim years when victory seemed still tragically distant, the United Nations held a series of conferences It was their business to consider ways by which nations might co-operate after the war

The Food Conference at Hot Springs Virginia, established the Food and Agriculture Organization in 1943

The United Nations Relief and Rehabilitation Conference at Atlantic City, New Jersey, set up the United Nations Relief and Rehabilitation Administration in 1943

An Allied conference on education was held in London in April 1944

The Monetary and Financial Conference at Bretton Woods, New Hampshire, laid plans for an International Monetary Fund and an International Bank in July, 1944

A civil aviation conference in Chicago established an international civil aviation board in November December, 1944

All these agencies dealt with special, technical questions, and could not be expected by themselves to insure co-operation among the United Nations over a long period of time It was planned that such special agencies might be fitted into a wide international organization that could offer a measure of military security and economic stability to all nations, large and small Plans for such an international organization were officially mentioned at the Moscow Conference of the United States, Britain and Russia in 1943 A later, at a meeting held at Dumbarton near Washington, D C, August 7, 1944, representatives

THE UNITED NATIONS

Representatives of the following nations signed the Charter of the United Nations Organization in San Francisco U S A June 26 1945

THE BIG FIVE
China
Union of Soviet Socialist Republics
United Kingdom
United States of America
France

Argentina
Australia
Belgium
Bolivia
Brazil
Byelorussian Soviet Socialist Republic (White Russia)
Canada
Chile
Colombia
Costa Rica
Cuba
Czechoslovakia
Denmark
Dominican Republic
Ecuador
Egypt
El Salvador
Ethiopia
Greece
Guatemala
Haiti
Honduras
India
Iran
Iraq
Lebanon
Liberia
Luxemburg
Mexico
Netherlands
New Zealand
Nicaragua
Norway
Panama
Paraguay
Peru
Philippine Commonwealth
Poland *
Saudi Arabia
Syria
Turkey
Ukrainian Soviet Socialist Republic
Union of South Africa
Uruguay
Venezuela
Yugoslavia

* Poland signed the Charter on October 15 1945

—the United States Britain Russia and China—drew up proposals for a United Nations organization

An important gap left in the Dumbarton Oaks proposals concerned the way in which the Security Council of this organization would vote This gap was filled in at the Yalta Conference February 4 12 1945 At Yalta in the Crimea were President Roosevelt Prime Minister Churchill and Marshal Stalin Shortly after this meeting representatives of the United States and of nineteen Latin American countries met in Mexico City Argentina alone of the American republics was not represented At this meeting February 21 to March 8 1945 the Act of Chapultepec was adopted This agreement provided for the defense of the Western Hemisphere in time of war It is expected that many such regional agreements will be reached in the future Finally, fifty of the United Nations (see box) gathered at the San Francisco Conference April 25 June 26 1945 to consider the Dumbarton Oaks proposals It was necessary to change these proposals so that they would fit into the general scheme of the Act of Chapultepec and regional security agreements which Russia had made with Britain France Poland Czechoslovakia and Yugoslavia At the close of the San Francisco Conference representatives of the nations present signed the charter of the United Nations Organization The charter is accompanied by the statute of the International Court of Justice

The United Nations Organization is known for short as UNO It consists of the General Assembly the Security Council the Trusteeship Council the Secretariat and the International Court of Justice

In the General Assembly all nations large and small have an equal voice The General Assembly is intended to serve as a town meeting for the United Nations, where all can say what they think It is to meet at least once a year, and more often if necessary

On the Security Council sit representatives of eleven member nations The United States Britain Russia, France and China are permanent members The other six members are to be chosen for terms of two years each by the General Assembly

In 1945, UNO had not yet chosen the city where its meetings will be held The place which it finally chooses will also be the home of the Security Council A representative of each of its eleven member nations must always be there, so that the Security Council will be able to hold its meetings and do its work every day, year in year out

The great purpose of the Security Council is to maintain international peace and to take steps against any nation that threatens the peace Its decisions can be questioned in the General Assembly by any of the United Nations But their discussions can not prevent the Security Council from taking prompt action in an emergency

In its difficult task of maintaining peace the Security Council will be aided by a Military Staff Committee Each nation member of UNO undertakes to tell the Council what armed forces and facilities it will place at the Council s disposal Each member will supply air force groups to the Security Council so that the Council may be able to act promptly against an attacking country

WHAT IS THE BIG FIVE S VETO POWER? WHY IS IT IMPORTANT?

The Security Council will be able to use these planes and other military forces on one condition only—when all five of the great powers agree that they be used One of the rules of the Security Council is tha each great power has the right to veto—that is to forbid—the use of force in maintaining peace Therefore no effective action can be taken against an aggressor without the consent of the Big Five This right of veto is the weakest spot in the United Nations Organization Either the United States or Britain or Russia or China or France may by its veto prevent the Security Council from taking action

The Economic and Social Council is responsible to the General Assembly It will deal with the prosperity and the welfare of people in all nations It may become as important in its field as the Security Council will be in keeping the world safe from an aggressor The various United Nations agencies which we have already discussed and others that may be created in the future are to be fitted into the Economic and Social Council This Council is to be composed of representatives of eighteen nations chosen without considering their military or industrial strength and it is in this Council that the small nations can make a most valuable contribution to the work of UNO

Another important organ which is also responsible to the General Assembly is the Trusteeship Council In the San Francisco Charter, the United Nations agreed to advance the welfare of dependent peoples and to promote their 'progressive development toward self government or independence UNO may act as guardian not only for territories taken from Germany Italy and Japan as a result of the war but also for colonies now controlled by the United Nations The administration of any territory placed in trust with UNO will be supervised by the General Assembly through the Trusteeship Council On the other hand the development of any part of such a territory designated as strategic will be supervised by the Security Council

The Secretariat will supply the people and the facilities to operate all the various parts of UNO and will carry out their technical work The Secretariat is to be headed by the Secretary General of UNO The International Court of Justice will consider disputes voluntarily brought before it by nations

The charter was signed by the representatives of fifty nations on June 26 1945 Then one more step was necessary To bring the charter into force it had to be ratified by twenty nine nations

The United States was the first of the powers to accept the San Francisco Charter On July 28 the Senate ratified the document by a vote of 89 to 2 This was a remarkable contrast to the refusal of the United States in 1919 to join the League of Nations

The twenty ninth nation ratified the charter on October 24 1945 and the charter became a part of the law of nations The twenty ninth ratification was that of the Union of Soviet Socialist Republics

The UNO is an experiment Whether or not it works will depend on all of its member nations But if we co-operate with each other, we can strengthen the web of our mutual interests Co operation will some day prove to be a greater safeguard against war than the most costly armaments



British Information Service

Co-operation English children send food to Europe

UNITED  STATES

WORLD WAR II is now at an end In the year 1945 the United States and its allies dealt the Axis a series of smashing blows that forced first Germany and then Japan to give up the fight May 8 was V E Day—the day of victory over the Germans in Europe The Japanese surrendered on September 1 United States time This corresponded to September 2 Tokyo time and September 2 was proclaimed as V J Day—the day of victory over the Japanese

The armed forces of the United States played an important part in bringing about the final defeat of the Axis powers American bombers and pursuit planes joined the British Royal Air Force in bringing destruction to the industries and the transportation system of Germany American armies took part in the final assault on the nazi fortress See the article on Europe

The contribution of the United States to the defeat of Japan was greater than that of any other nation American land forces won all important bases on the islands that ringed Japan s empire American naval and air power was chiefly responsible for driving the once mighty Japanese navy from the seas The fearful air bombing of Japan s home islands was almost entirely the work of American planes

Many scientists—British Canadian French German and Danish as well as American—contributed directly or indirectly to the development of the atomic bomb Yet it was the United States which made it a practical weapon—a weapon that destroyed the Japanese will to resist almost in a day See the articles on Asia and on Atomic Energy

President Franklin D Roosevelt the great wartime leader of the United States did not live to see the final day of victory He died suddenly on April 12, 1945, at Warm Springs Georgia and was succeeded by Vice-President Harry S Truman Roosevelt s death had little or no effect on the outcome of the war, since his successor carried on his military policies However, it seemed tragic that the man who had led the country so far along the road of victory should die less than a month before V E Day

Modern warfare is not carried on entirely on the field of battle It is also waged in the factories which turn out the supplies of war ships tanks guns ammunition—without which a great army would be a helpless mob The United States which is the most highly industrialized country in the world played the leading part in this war behind the lines

America s war production was almost unbelievably great Chairman J A Krug of the War Production Board revealed in October 1945 that in five years America had made 97 000 bombers and 200 000 other military planes 71 000 warships 86,388 tanks 2 435 000 trucks 17,400 000 rifles and side-arms 41,000 000 000 rounds of small arms ammunition and 43 270 000 woolen blankets

The United States was able to equip its own vast armies and also to ship supplies under Lend Lease to its allies In a report issued toward the end of August President Truman announced that up to July 1 1945 the United States had supplied its allies with $42 809,382 000 worth of goods on lend lease terms Great Britain had received the lion s share—42 per cent, Russia had received 28 per cent Nearly half of all Lend Lease consisted of munitions and ships Industrial goods food oil and various services made up the rest

America s allies contributed to her needs under reverse Lend Lease in the form of barracks airfields offices, places of recreation food and so on Up to July 1945, the United States had received $3 600 364 000 worth of reverse Lend Lease Most of this was supplied by Great Britain and her dominions of Australia and New Zealand

Of all the chief partners in the struggle against the Axis the United States alone escaped the destruction that makes modern war so terrible Her cities were not bombed her fields were not laid waste her industrial plants remained intact

Yet if the horrors of war were not carried to America s soil the constant fighting all over the world took a heavy toll of American fighting men A report issued in October 1945 listed the Army s casualties at 922 583 (By casualties we mean men lost to the fighting services because they have been

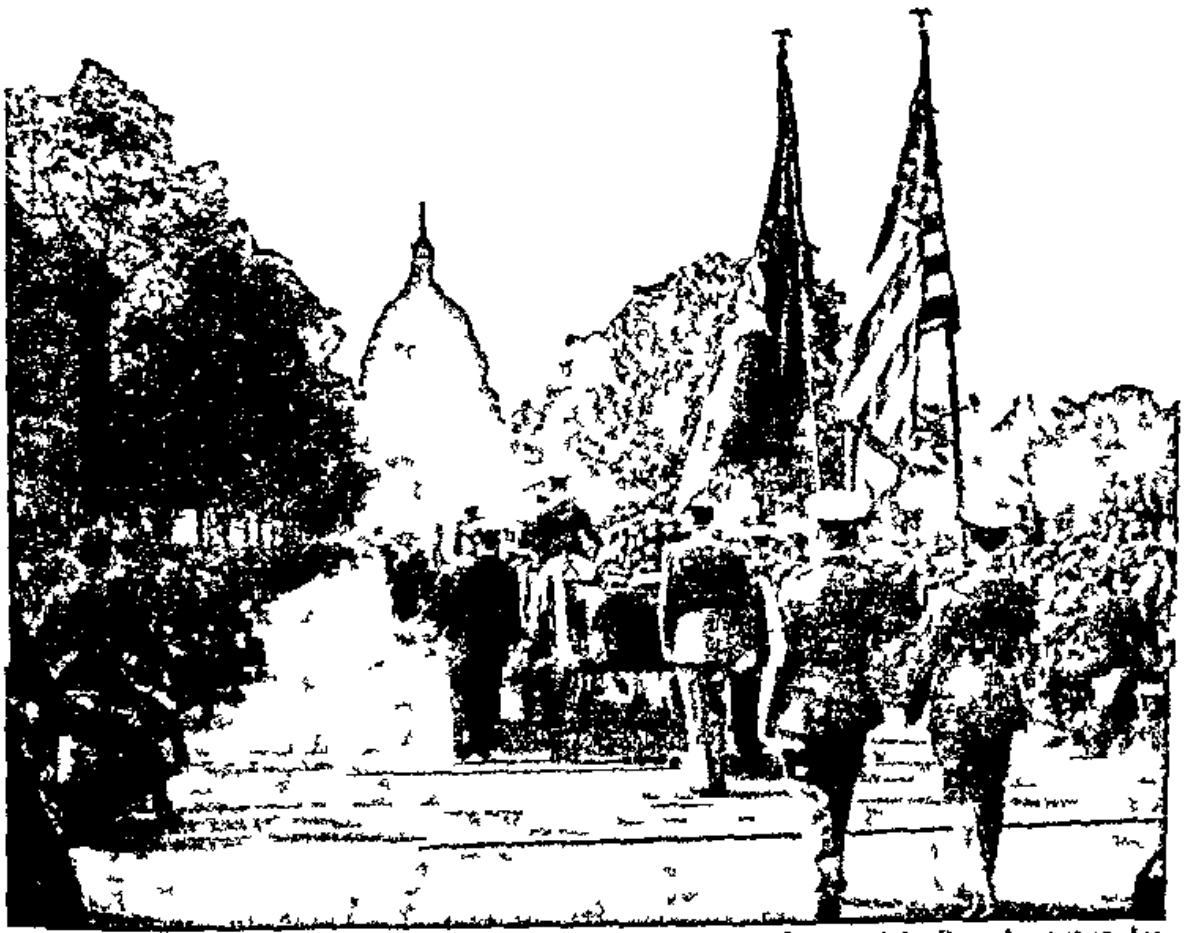
killed wounded captured or sick or because they are missing) Navy losses in the same period amounted to 145 570 The total American casualties were about three times those suffered in World War I

The financial cost of the war to the United States has been staggering By V J Day the United States had spent on war a total of $287 181 000 000—far more than any other country had ever spent for this purpose But this amount does not represent the total cost of the war to the United States In the years to come many more billions will have to be spent on pensions for service men and women on education and other benefits for veterans in interest on loans and the like The total figure will probably be several times as great as the one that we have given above

After the fighting was over, the victorious Allies faced the problem of rebuilding a shattered world First of all it would be necessary to feed the hungry and give shelter to the homeless The principal part in this work of charity has been played by the United Nations Relief and Rehabilitation Administration (UNRRA) an organization composed of forty four members of the United Nations The United States has contributed almost three-quarters of the total funds of UNRRA An American Herbert H Lehman is the director general of the organization

While UNRRA provided valuable help in the form of immediate relief it could not solve other problems brought about by the most terrible war in all history It would be necessary to build new houses factories and merchant ships to replace those destroyed in the war It would be necessary to restore wrecked transportation systems It would be necessary to provide new farm equipment and new equipment for oil fields The nations of the world looked for help to the United States which had suffered least from the ravages of war

America made it clear that she was willing to do her share in helping to bring back world prosperity In July 1944 delegates



Photograph by Press Association Inc

Bearing the flag-draped coffin of President Roosevelt toward the Capitol, en route to the White House services.

from forty nations had signed an agreement called the Bretton Woods Monetary Plan It proposed to set up a special fund to support the currencies of needy countries It also provided for an international bank which would lend money for reconstruction work in regions laid waste by the war In July 1945 the United States Congress passed a bill formally approving the Bretton Woods plan When President Truman signed the measure on August 4 the United States became the first country to take official action on the proposal

SHORTLY AFTER THE WAR'S CLOSE IT WAS ANNOUNCED THAT LEND LEASE WOULD END

Some members of the United Nations expected that they would continue to receive lend lease supplies after the end of the war But on August 21 1945 President Truman announced that steps would be taken at once to discontinue all lend lease operations and to notify foreign governments receiving Lend Lease of this action

Great Britain protested strongly other countries also expressed their fear of the consequences But President Truman made it clear that Lend Lease was definitely at an end He pointed out that the United States was willing to help its partners among the United Nations with substantial sums in order to bring back prosperity to each and every one But these sums would be granted only in the form of loans

A very delicate question in connection with Lend Lease has always been Would the countries receiving supplies be required to pay for them at some future time? Unfortunately the original Lend Lease Act did not deal clearly with this matter In a report sent to Congress on August 30 1945 President Truman warned the United States not to expect payment for the great bulk of the lend lease supplies shipped to our allies

If we insisted on full payment for these items said the President we would upset the financial structure of these allies and we might well lay the foundation for a third world war The President's remarks were not favorably received by Congress Secretary of State Byrnes hastened to point out that the President had not set up a policy but had made only a suggestion

The United States has taken a prominent part in the effort to bring about world peace through a new league of nations—the United Nations Organization (UNO) A definite plan for this world union was prepared at the Dumbarton Oaks Estate near Washington D C in August September, 1944 Delegates from fifty nations signed the permanent charter of the UNO at San Francisco on June 26 1945 See the United Nations and World Peace

The end of the war found the United States with by far the biggest military machine in its history The Army numbered some 8 050 000 men and women only the Russians among the Allies had more men in the field Of course this huge force which was necessary to fight an all-out war, was far greater than would be required to guard the country in time of peace Therefore after V E Day the Army began to discharge its officers and men in accordance with a carefully prepared system

This was based on (1) the length of time in service (2) the length of time overseas (3) certain decorations won in service (4) the number of dependents It is estimated that the Army discharged 2,000 000 men between V E Day and the end of 1945 About 6 000 000 will be released by July 1 1946

On V J Day the United States Navy was by far the largest in the world It numbered 3,380 000 men and women it had about 100 000 ships and boats of all classes including 1 500 warships Secretary of the Navy Forrestal announced that the Navy meant to reduce its numbers to a peacetime strength of 550 000 including 50 000 officers

It was planned to keep about a thousand combat ships with supporting aircraft and supply vessels One third of the fleet was to be kept fully manned and ready for any emergency One third was to be held in reserve and ready for action at short notice One third would be taken out of active service but would be available for service at some future time if needed

THE ARMY AIR FORCES SHOWED AN INCREASE OF OVER 3800 PER CENT DURING THE WAR

On V J Day the Army Air Forces (AAF) numbered 2 300 000 men and women an increase of more than 3800 per cent since the United States entered the war in December 1941 It was planned to cut the AAF to about 900 000 by July 1 1946 After that time the figure would be reduced still further probably to about 700,000

On November 20 1945 President Truman announced a change in the leadership of both the Army and the Navy General of the Army George C Marshall Army chief of staff and Fleet Admiral Ernest J King chief of naval operations had sent in their

resignations General Marshall was replaced by General of the Army Dwight D Eisenhower the successor of Admiral King was Fleet Admiral Chester W Nimitz

To provide necessary replacements for the armed services it was planned to continue the draft of men between the ages of eighteen and twenty six for some time to come In October, 1945 President Truman urged Congress to pass a law setting up a permanent peacetime draft He recommended that young men between the ages of eighteen and twenty should be required to undergo a year s military training They would then become members of the general reserve for a period of six years Congress had not acted on the President s suggestion by the end of 1945

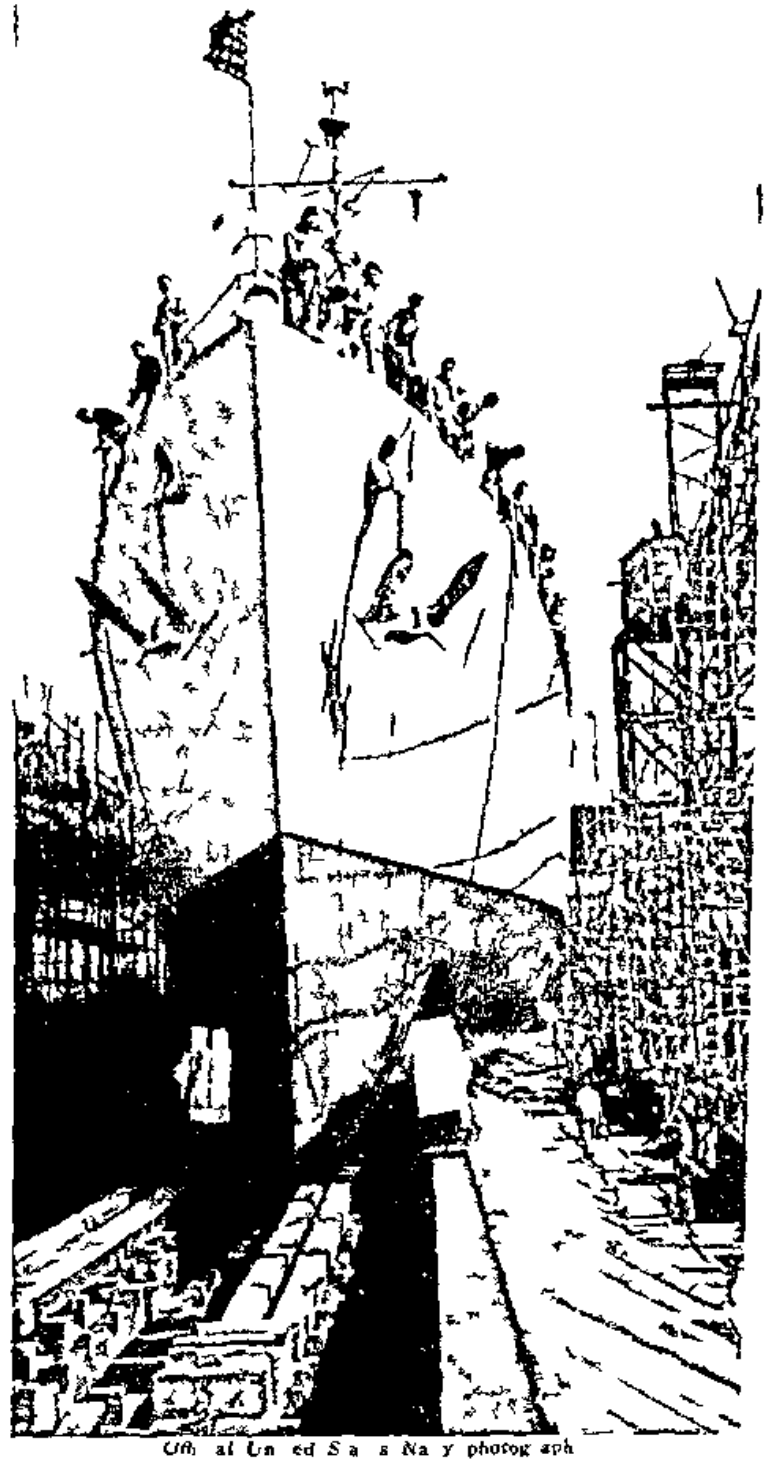
THE PROPOSAL TO UNIFY THE ARMED FORCES BRINGS FORTH MANY DIFFERENT OPINIONS

Another important military matter that came up for discussion after the end of the war was the question of uniting America s armed services under a single head In October 1945 the War Department offered a unification plan to the Senate Military Affairs Committee Under this plan the Army Navy and Air Forces would be placed under a single civilian Secretary of the Armed Forces There would also be a Chief of Staff of the Armed Forces he would act as chief adviser to the Secretary

The Navy was bitterly opposed to the War Department s unification plan Secretary of the Navy Forrestal maintained that the rivalry between the services was a healthy one and should be kept Toward the end of November he offered another plan which he said would bring about real unification of the armed forces The Forrestal plan provided for a permanent national security council made up of the President the Secretaries of State of War and of the Navy and the chairman of a new national resources board The President would act as the chairman of the security council

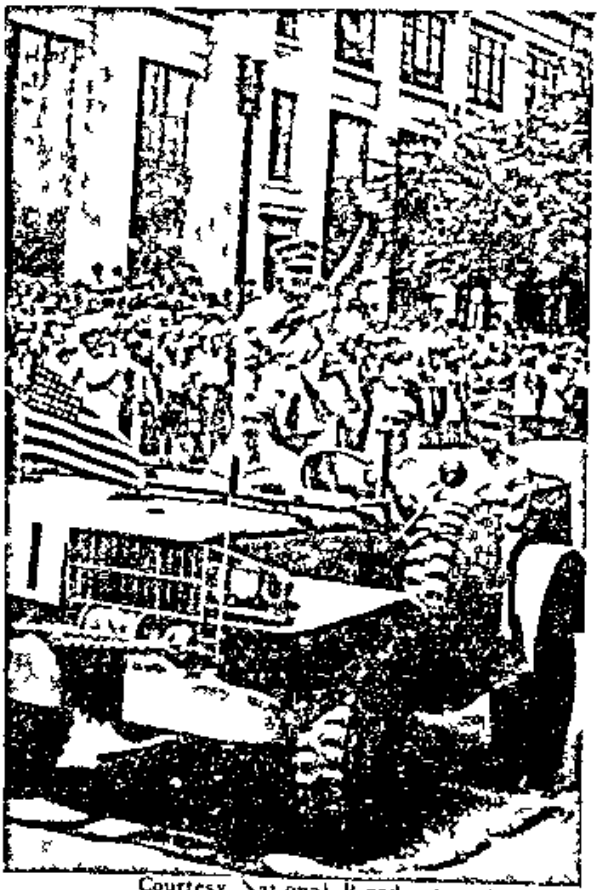
Those in favor of unification claimed that lack of co-operation between the Army and Navy had been chiefly responsible for the heavy losses suffered on December 7 1941 when the Japanese attacked Pearl Harbor In November 1945 a congressional committee began a thorough investigation of the Pearl Harbor disaster This committee was made up of five senators and five representatives—six Democrats and four Republicans

It is difficult to set up a definite military policy for the future because the atomic bomb threatens to change all accepted ideas about warfare The striking power of this new weapon is so great that a single surprise attack might cripple the mightiest nation fatally in a few hours It is true that at present the United States alone has the secret of manufacturing the bomb But those who know most about the matter claim that other nations will have atomic bombs in five years



Official United States Navy photograph

A hard hitting new destroyer slides down the ways in a wartime launching It joins the world s biggest navy



Courtesy National Broadcasting Company

General of the Army Dwight D Eisenhower on his return to Washington D C waves to the crowds

—or perhaps even in a shorter time

Some people think that the United States should help quiet the fears of the world by sharing its secret with other nations Other people feel that this country should keep the atomic bomb a secret as long as possible and that research in atomic energy should be strictly controlled in the interest of national defense Such was the aim of the May Johnson Bill introduced into Congress in October, 1945 Thus far, no action has been taken on the measure

Great Britain and Canada have been closely associated with the United States in the development of the atomic bomb British and Canadian scientists worked on the project in the United States Canada made available the Great Bear Lake deposits of pitch blende This is one of the world s greatest stores of uranium bearing ore—the ore from which atomic energy is derived at the present time

In November, 1945, Prime Minister Attlee of Great Britain and Prime Minister Mackenzie King of Canada went to Washington in order to discuss with President Truman the future of the atomic bomb The three statesmen issued a joint statement in which they recommended (1) that the secret of the bomb should be kept by the United States for the present (2) that steps should be taken by the United Nations Organization to outlaw the use of atomic energy in warfare and to promote its use for peaceful purposes

The year 1945 was one of the most critical in the history of American industry It was a year in which the country had to change from a wartime to a peacetime basis Thoughtful people had realized that this task of reconversion or changing over, would be a difficult one It would take time for war industries to turn to the manufacture of civilian goods and during this period many people would be without work Veterans returning to civilian life would add to the number of the unemployed Again the easing of wartime controls over prices and wages might lead to runaway inflation How did the country meet these problems in 1945?

As the year opened the country was in the midst of the war effort We have already told you of America s vast war production, which left friends and foes far behind Yet it is curious to note that in the early months of 1945 the United States faced a serious man power shortage in certain industries. A number of workers had left their war jobs for jobs in civilian industry because they thought the war would be over soon Others had become discouraged because of housing or transportation difficulties

LABOR PROBLEMS IN ESSENTIAL INDUSTRIES BRING FORTH NEW PROPOSALS IN CONGRESS

In an effort to provide enough workers for essential war work, the Roosevelt Administration tried to push a labor draft bill—the May Bailey Bill—through Congress The House passed the measure in February, but the Senate Committee on Military Affairs refused to bring it to the floor of the Senate The Administration then supported the Kilgore-O Mahoney Bill, which proposed to relieve the man power shortage by strengthening the nation s War Man Power Commission The Kilgore-O Mahoney Bill also failed to win the approval of Congress

While certain industries were desperately searching for workers, in other industries there were a number of cutbacks—that is reductions in original schedules On March 27 the Navy announced that seventy two combat ships had been cut from the naval building program of eighty four announced

on March 6 There were also cutbacks in the manufacture of ammunition tanks small arms and powder As a result a number of workers lost their jobs.

The industrial picture changed suddenly after V E Day even though the war against Japan had not yet been won Cutbacks increased by leaps and bounds so did the number of unemployed Industries that had hitherto been prosperous found themselves without the war orders on which their prosperity had been based Soon the country found itself plunged in the difficulties of the reconversion period

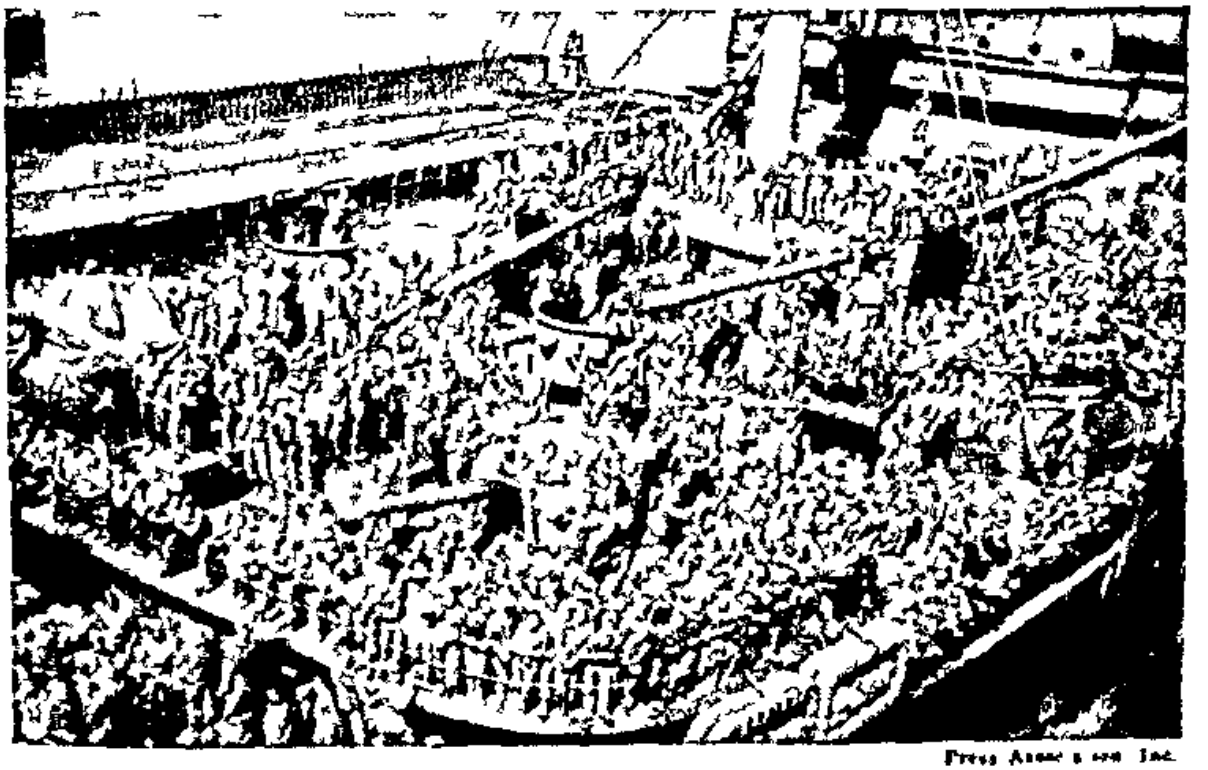
Certain steps had been taken before V E Day to prepare for the coming of reconversion Congress had safeguarded veterans returning to civilian life by passing in June 1944 a bill known as the GI Bill of Rights (*GI* is a war slang term meaning an ordinary soldier) This measure provided free schooling a years unemployment compensation generous loans and other benefits to veterans

In October, 1944 an Office of War Mobilization and Reconversion had been set up in order to supervise the entire reconversion program At the same time a three man Surplus Property Board had been created in order to dispose of the billions of dollars worth of unused war supplies that would be on hand when the end of the war came

In March 1945 three leaders of labor and industry had met at Washington in order to discuss the labor situation in the reconversion period These men were President William Green of the American Federation of Labor President Philip Murray of the Congress of Industrial Organizations and President Eric A Johnston of the United States Chamber of Commerce They drew up a seven point charter which aimed to *bring about a new era of peace and harmony* in the field of labor relations The charter guaranteed collective bargaining high wages and the rights of private property under the system of capitalism

The War Production Board promised that it would release needed materials for the use of civilian industry with the coming of peace —*perhaps even before that time if possible* The Office of Price Administration promised to do away with the complicated system of rationing as soon as possible

All these measures represented at least the beginnings of a return to peacetime ways of living Yet much had been left undone What of unemployment? War workers losing their jobs would be entitled to unemployment compensation given by the states But the various state systems differed widely in some states the amounts granted were very



Press Association Inc.

Returning soldiers of the African and Italian campaigns express their homecoming joy as they dock at New York.

small In 1944 President Roosevelt had backed a bill providing for adequate compensation to the unemployed for a period of six months Congress had refused to pass the measure

Nothing had been done either to set up a wage policy for the reconversion period During the war workers in defense industries and many workers in civilian industries had worked forty eight hours a week on an average with pay and a half for overtime after forty hours With the coming of peace there would be no overtime work in most industries Labor leaders announced that they would seek large increases in wages in order to make the amount of take home pay about the same as before Some people claimed that such an increase would greatly increase prices and perhaps lead to runaway inflation

And what of strikes? If they became widespread they might hamper industry seriously in the reconversion period and both industry and labor would suffer Senators Ball Burton and Hatch had introduced a measure providing for compulsory arbitration in labor disputes Congress refused to consider this bill because the Administration organized labor and management were all opposed to it

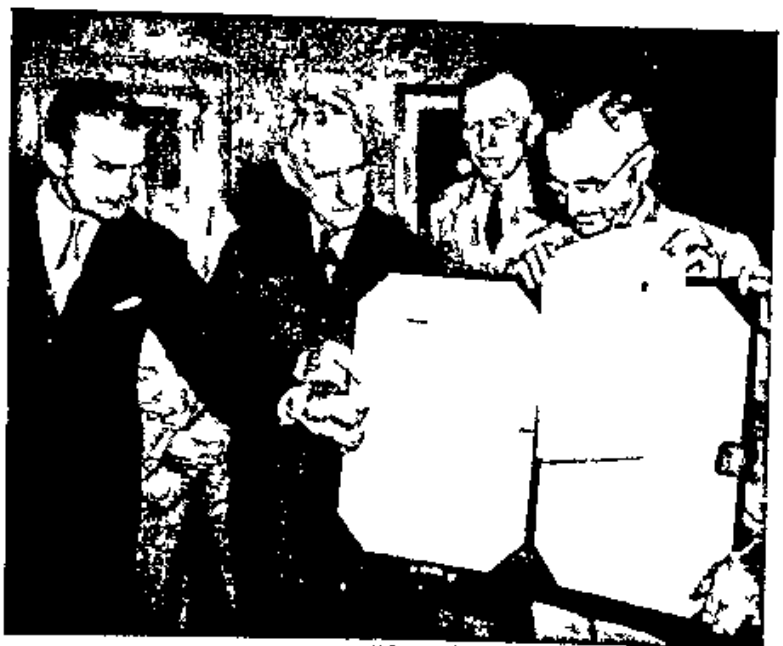
And so the country entered upon the period of reconversion with only a partial program The result was great confusion As had been foreseen the unemployment problem became serious Half a million men and women lost their jobs in the month after V E Day The United States Employment Service (USES), a wartime agency which provided free employment service for workers was swamped with applications for jobs

Now a curious situation arose In some areas where the number of unemployed rose sharply many factories reported that they were desperately in need of workers and could find none There were various reasons for this Some men had worked long hours for high wages in war industries they felt that they needed a rest and they could afford to take one Some of the jobs that could not be filled required special skill which many of the unemployed did not possess In other cases the wages offered were low A man taking a job of this kind would not get much more money than he would if he remained idle and collected unemployment compensation

And so certain industries were hampered by lack of workers in their effort to get back to peace production Other industries were held back by strikes Some strikes were called because workers were dissatisfied with working conditions or because they wanted to have certain union groups recognized Most strikes however were the result of wage disputes The efforts of labor leaders to obtain large increases were met with a flat refusal in almost every case and this led to crippling stoppages of work in many important industries The Green Murray Johnston charter was ignored in this crisis It had never been anything but a hopeful statement of principles It had never been accepted by organized labor or by industry as a whole

The coming of V J Day brought new troubles There were more cancellations of war orders Great numbers of soldiers and sailors returned to civilian life and joined the crowds of those seeking jobs Congress had adjourned for the summer the House on July 21 and the Senate on August 1 It had been planned to have the recess last until October 8 But in view of the crisis President Truman called Congress into special session on September 4

The President now pre-

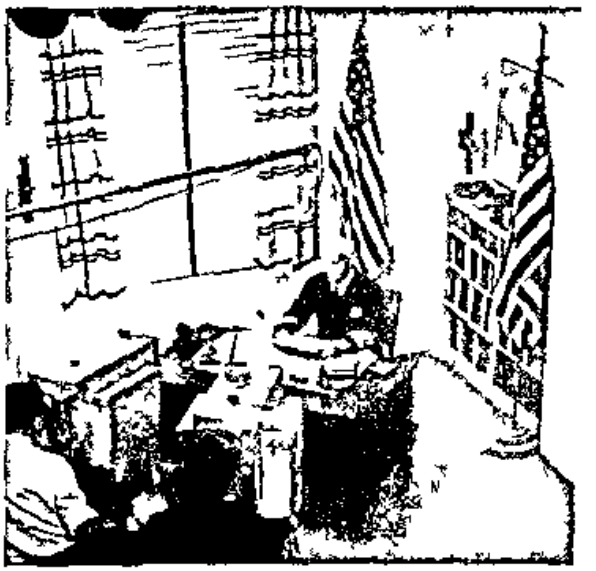


Official United States Navy photograph

President Harry S Truman joins with high military and naval leaders in inspecting the original document which recorded the surrender of the Japanese The signing took place on board the battleship Missouri in Tokyo Bay

sented to Congress a far reaching program which would deal with all the difficulties brought about by reconversion Among other things he proposed (1) to hold the line on prices for a time, (2) to hold wages in line where increases would lead to higher prices (3) to remove government controls where possible (4) to extend federal aid to the states so that each state would be able to pay its unemployed people up to $25 a week for twenty six weeks (5) to insure full employ ment in the days that lay ahead (6) to pro vide a well rounded crop insurance program

Congress refused to heed the Pres dent s plea for speedy action on his program The situation continued to be serious The na tion s entire industrial production was threatened in September by strikes in the vital oil and coal industries On October 4 the President ordered the Navy to seize and operate twenty six oil producing and refin ing companies in order to get the strikers back on their jobs The Government would probably have taken action in the coal strike too if President John L Lewis of the Mine Workers Union had not ordered the strikers back to work on October 17



Offic al Un ed S es Na y p o g ap

A television speech by Fleet Admiral Chester W N mitz

GOVERNMENT POLICY ON WAGES AND PRICES IS ANNOUNCED

On October 29 the President announced that the Government would no longer seek to control wages He announced however that manufacturers granting wage increases would not be allowed to increase prices without government approval Price increases based on increases in wages would be permitted only if (1) previous wage increases had not kept up with the cost of living (2) wage increases were necessary to make wage rates more or less equal among plants in the same industry or place (3) wage increases would have to be granted in order to insure full production in an essential industry The President declared that industry as a whole could afford substantial wage increases without any general increase in the price level But most manufacturers disagreed

On November 5 a labor management con ference was opened in Washington in an other effort to bring about peace on the home front There were eighteen labor delegates eighteen management delegates and three non voting government representatives The labor delegates were drawn from the ranks of the American Federation of Labor, the Congress of Industrial Organizations and two independent union groups—the railway workers and the mine workers The confer ence failed to bring labor and industry to gether Serious strikes continued to endanger the entire reconversion program

The nation s farmers were handicapped by unfavorable weather April frosts caused great damage in many areas floods raged in the Middle West Nevertheless the 1945 crop was unusually large and farmers en joyed another prosperous year The Bureau of Agricultural Economics estimated that the farmers cash income from the sale of their products amounted to over $20 000 000 000 in the year 1945

The problems of reconversion have af fected all Americans—even those who have taken no direct part in the conflict between labor and industry For one thing it has meant the eas ng of many controls which had been in effect during the war A number of articles had been rationed in order to as sure a fair supply to all After V J Day first one article and then another was taken from the ration lists The most far reaching step in this direction was taken on November 23 1945 when all foods except sugar became ration free The only articles that are now rationed are sugar and passenger automo bile tires

Price controls are still in effect and will probably be applied for some time to come The Office of Price Administration (OPA) sometimes raises prices on certain items in order to encourage production but in gen eral it has tried to hold the line against in flation The OPA has received the support of organized labor but has been severely at

tacked by the country s manufacturers

In spite of price controls it seems certain that the price of food will rise as subsid es (special payments) are l fted The Govern ment has been paving these subsidies to pro ducers of agricultural or dairy products (1) to enable the farmer to make a reasonable profit and (2) to keep the prices of food ar ticles from rising

STOPPING AID TO FARMERS MAKES FOOD PRICES GO UP

In November 1945 the Government an nounced that subsidies would be gradually removed between that month and June 30 1946—the date that Congress had set for the lifting of all subs dies The effect of such a program was seen on November 8 when the Government removed one of the two sub sidies controll ng the price of butter As a result there was a rise in price of between five and six cents a pound

Toward the end of November 1945 offi cials of the OPA and the Department of Agriculture issued a report on the removal of subsidies They predicted that as a result the prices of at least thirty seven important items would increase from 10 to 40 per cent The items included meats bread butter milk canned vegetables cheese and dried fruits These increases could be avoided only if Congress voted to restore all subsidies that it had previously granted

The hous ng situation which was serious in wartime became even worse after V J Day Conditions were particularly bad in the larger cities Many of the people who had been drawn to these cities because of war work decided to remain after the war Re turning veterans added to the number of those seeking suitable quarters It was clear that a huge building program would be nec essary to ease the hous ng shortage

The coming of peace has lightened the burdens of American taxpayers In Novem ber 1945 Congress passed a bill provid ng for considerable reductions in taxes for both corporations and individuals on income for 1946 Th s measure will bring about a tax cut of about $6 000 000 000 it w ll remove an estimated 12 000 000 Americans from the nation s tax rolls

Organized labor continued to make steady progress in 1945 The American Federation of Labor (AFL) has about 7 000 000 mem bers the Congress of Industrial Organiza tions (CIO) 6 500 000 A large number of workers estimated at from 2 000 000 to 4 000 000 are organized in independent un ions—that is unions not forming part of the AFL or CIO

The National Labor Relations Board (NLRB) made an important labor decision on March 26 1945 It announced that fore men and other supervisors can form unions for the purpose of collective bargaining and that employers must recognize and bargain with these unions This ruling reversed an earl er decision of the board However the NLRB left unanswered the question whether foremen would be permitted to be in the same unions as the men whom they super vise At present the most important union of foremen is an independent one—the Inde pendent Foremen s Association of America

Another problem of deep interest to labor is that of full employment throughout the year Many industries are seasonal that is they offer employment for only part of the year Organized labor has held that this pol icy is unfair to workers and that they should be guaranteed a definite yearly wage Only a few industries have g ven such guarantees of employment it is estimated that fewer than 50 000 workers are covered by such an agreement

On July 28 1945 the National War La bor Board issued an order providing for a guarantee of full employment throughout the year for 300 shoe salesmen in New York City This was the first order of the kind ever issued by the board A week or so later government investigators began a careful study of the problem of guaranteed employ ment This study is still under way

THERE WERE MANY CHANGES IN THE CABINET AFTER HARRY S TRUMAN BECAME PRESIDENT

There were changes in the presidential cabinet in 1945 On January 21 Secretary of Commerce Jesse Jones resigned at Presi dent Roosevelt s request The Pres dent then named Henry A Wallace former vice pres dent to succeed Mr Jones The Senate re fused to confirm the nomination unt l the office of Secretary of Commerce had been deprived of certain lending powers that had been exercised by Mr Jones Wallace was confirmed at last on March 1

When Mr Truman became president in April it was freely predicted that there would be a big shake up in the Cabinet This prediction was certainly fulf lled Over a pe riod of four months there were no less than seven Cabinet changes as follows (1) Post master General Robert E Hannegan re placed Frank C Walker (2) Attorney Gen eral Thomas C Clark replaced Francis J

Biddle (3) Secretary of Agriculture Clinton P Anderson replaced Claude R Wickard (4) Secretary of Labor Lewis B Schwellenbach replaced Frances Perkins (5) Secretary of State James F Byrnes replaced Edward R Stettinius Jr (6) Secretary of the Treasury Fred M Vinson replaced Henry Morgenthau Jr (7) Secretary of War Robert P Patterson replaced Henry R Stimson

There were also many changes in the government agencies that had sprung up during the war Some were abolished these included the Smaller War Plants Corporation (SWPC) the Office of War Information (OWI) the Office of Economic Stabilization (OES) the Office of Strategic Services (OSS) and the War Production Board (WPB) In most cases the duties of these organizations were turned over to other federal agencies

The important National War Labor Board was still in existence at the end of 1945 but it had changed its policies considerably It refused to take up disputes between employers and workers unless both sides agreed to accept the board s decision Furthermore it no longer ordered strikers to go back to work it merely requested them to do so

There was only one change in the membership of the United States Supreme Court in 1945 On July 5 Associate Justice Owen J Roberts resigned he announced that his resignation was to take effect on July 31 Justice Roberts a Republican had been appointed by President Hoover in 1930 On September 18 President Truman nominated another Republican Senator Harold H Burton to succeed Justice Roberts The nomination was confirmed by the Senate the next day

Associate Justice Robert H Jackson of the Supreme Court was named by President Truman as the chief United States counsel on the International War Crimes Tribunal a court set up by the Allies in order to try Axis war criminals Justice Jackson obtained a leave of absence from the Supreme Court in order to serve on the Tribunal This body opened its trial of accused nazi leaders on November 20 1945 After the nazi defendants had all pleaded not guilty Justice Jackson opened the prosecution s case Claiming that the real complaining party at your bar is civilization he charged that the defendants were responsible for the war that Hitler planned war with the United States in 1940 and that the Japanese plotted in 1939 to assassinate Josef Stalin The legal proceedings were watched with interest due to their lack of precedent in international law

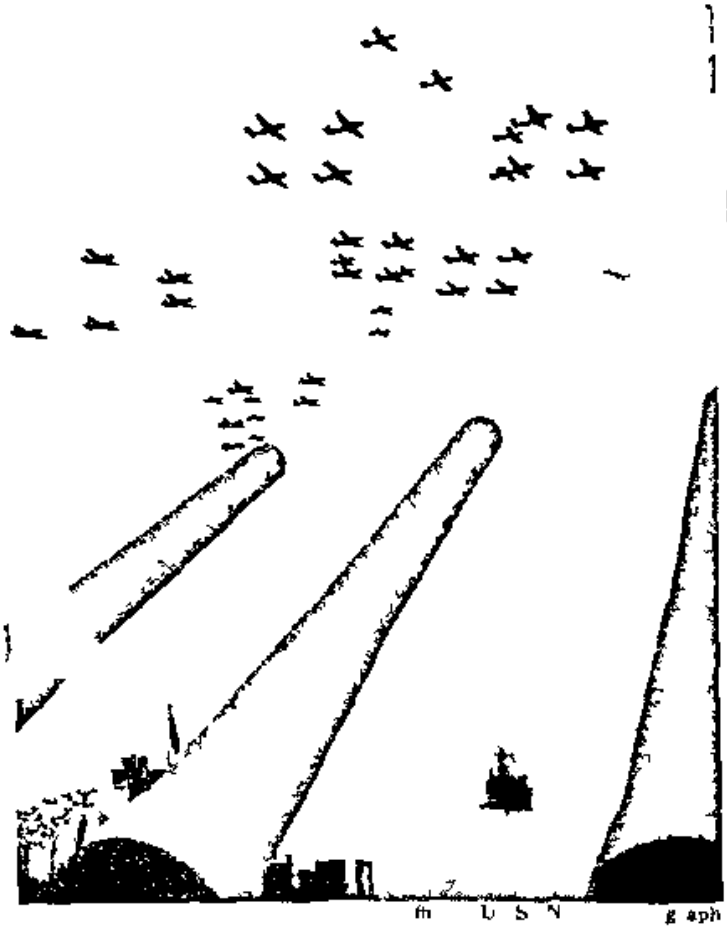
Such is the story of the United States in the year 1945 It ended on a rather doubtful note America had come through the ordeal of war with flying colors but she had not done so well in solving the problems that peace brought with it There seemed to be need of recalling to all Americans the lesson learned in the trying days of war that in unity there is strength



R J Thomas, national president of the United Automobile Workers addresses strikers

Acme photograph

ing workers at the General Motors plant in Linden New Jersey



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Ameri an p anes sos o e the m gb y USS M ason as Japan surr nders forma y



Bri h nf rma n Se e

German offi e s a ri e to yie d a b g part of the na i arm es to Bri ish Gene a Mon gomery

V-DAYS

A Japanese p e offi al x ous ed und h s conquer ors co d wa b ul ey s.

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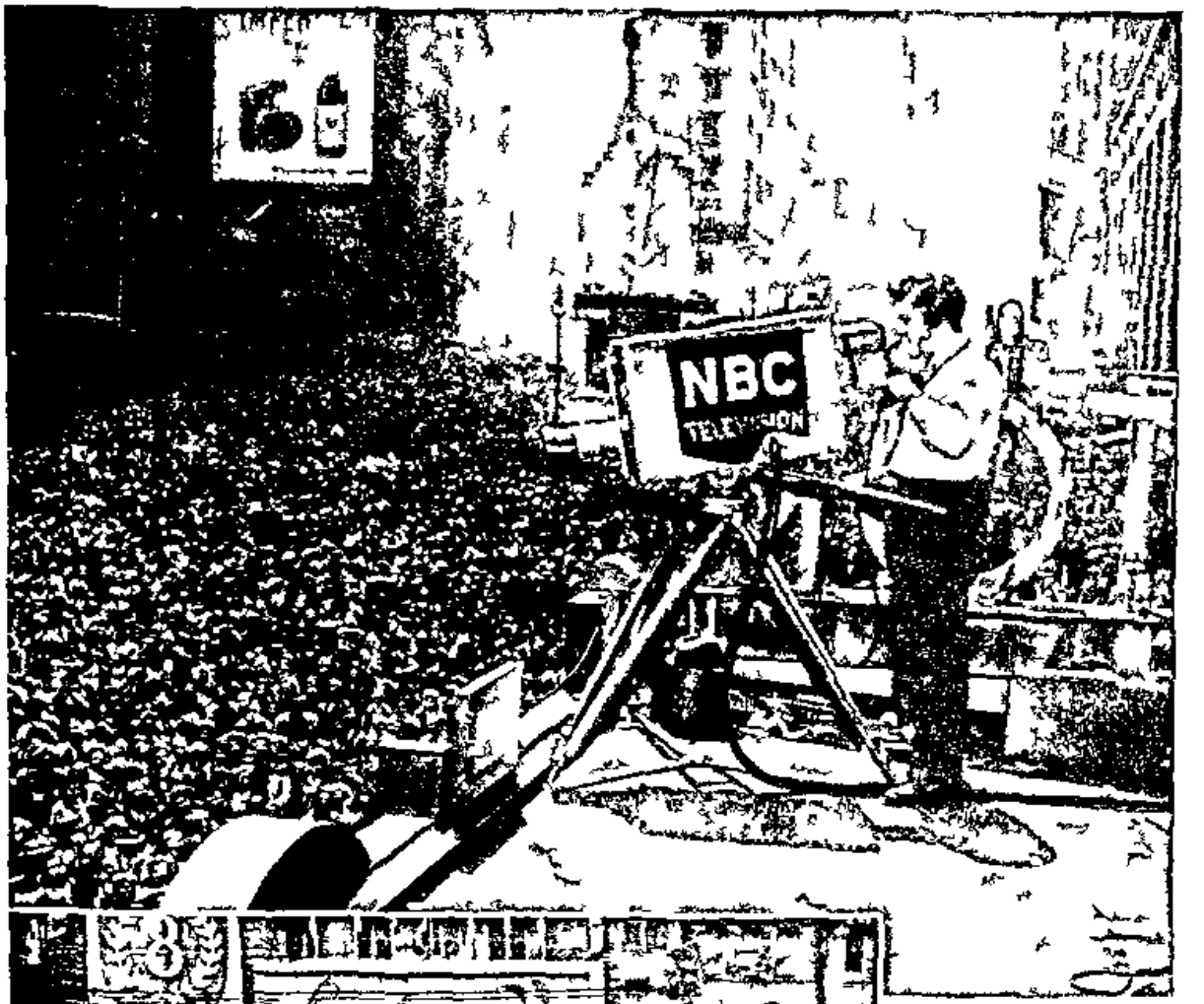


Marines who began the great offensive against Japan li ten o ad o news of the wa s end

Offi a U S Ma n Corps photo



CITY CROWDS GREET VICTORY IN EUROPE



NBC ph o

Throngs pa k Times Squa e New Yo k happy hat part of he fighting is ove As they li en for the atest news the s ene is caught by televis on



The Toron o S s

A y ond Canadian Navy band struts its stuff" in Toron o s ce ebration parade Joy is tempe ed everywhere however by thought of the job sti l to be fin shed in the Pa cific

WAVES

By Gerald J. Holton

Harvard University

OUR whole universe is filled with rays, shooting past or through one another at enormous speeds Unlike sound (which needs some medium like air or water through which to move) all these various kinds of radiation can travel through quite empty space, such as the lonely vacuum between the sun and our earth They are really an absorbing study, and a study which affects many other miracles of nature

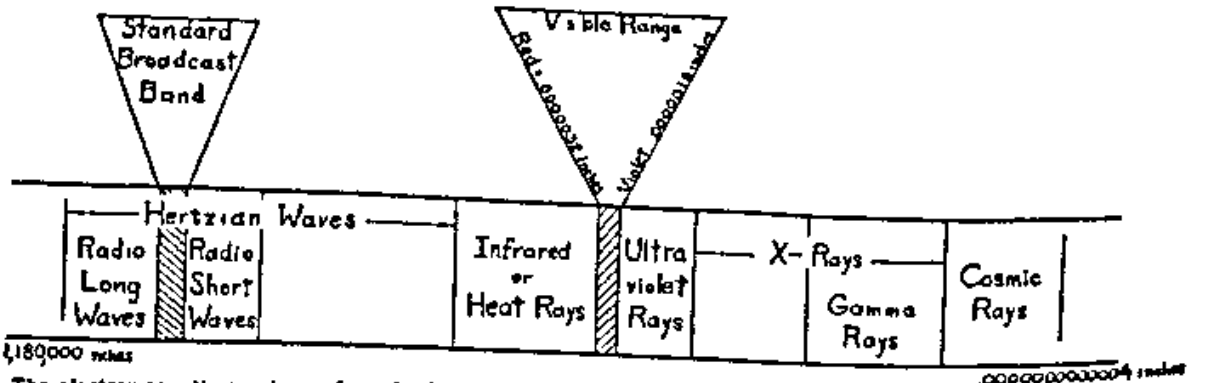
In discussing a topic of this sort which is so closely connected with many other scientific wonders, there is a possibility of men tioning allied subjects which have been treated elsewhere in your book It is felt, however, that the great interest in rays jus tifies a separate and complete explanation

LIGHT, THE RAYS BY WHICH WE SEE

The rays we know best are the visible rays of light This light belongs to a great family of waves In this family there are also light waves we can not see—infrared waves and ultraviolet waves—as well as X rays, gamma rays and radio waves

This is a good place to tell what the difference is between a ray of light and a wave of light Suppose you dropped a stone into a still pool of water, and watched the dis turbance it created If the center of all that disturbance were to be considered a light bulb, then the ripples, or waves, of water that go out in all directions from that center might be thought of as waves of light If, however, you were to draw a straight line from the very center of the disturbance to a point on the shore of the pool, this line would indicate the direction of the wave motion with reference to that point on shore This line would be called a ray It is a term that is loosely used to designate any narrow beam of light

Two other terms you will often see in any discussion of light are wave length and frequency These may be explained as follows Suppose you could run from one pole to an other ten yards away in one second, then to another ten yard pole in one more second and so on past ten poles till you have run one hundred yards in ten seconds The rate of your running would be ten yards, or one pole length, in one second In science, your rate might be known as your frequency, and it would be one pole length per second Saying the same thing in a different way, the en tire course of one hundred yards is divided into ten lengths of ten yards each There are then ten complete lengths, or cycles, in all, each cycle being ten yards Science calls this distance the wave length, or the distance be tween two corresponding points on adjacent cycles It is then easy to see that, if the dis tance between poles, or wave length, is in creased the rate of your running one pole length, or your frequency, would decrease



The electromagnetic spectrum above is charted in approximate wave length values It includes visible light-rays and standard broadcast waves. The latter vary in range from 7,900 to 21 500 inches, or 550 to 1,500 kilocycles.

As physicists say, the wave-length is inversely proportional to the frequency

But let us get back to the light rays how are they created? When one of the outer electrons of an atom is disturbed in its regular rotation about the nucleus—for instance by a collision with a 'free' electron—then a small bundle of pure energy is hurled away from the atom as the displaced electron jumps back into its own orbit This bundle of energy is sometimes called a quantum, sometimes a photon It flies away at tremendous speed—186 000 miles per second If some special power were given you so that you could look into an atom and see the disturbed electron being knocked out of its place, and then darting back into place again you would see a tiny flash of light Such a small flash would not amount to much But suppose you could see the same thing happen in many neighboring atoms at about the same time—then you would really see light being created—many photons shooting out together and forming a spreading light wave The more violent the atomic disturbances that create the photons the greater is the energy each represents And the shorter the wave length the higher is the frequency of the resulting light rays.

Light waves with a wave-length of thirty millionths of an inch arouse in our eyes the sensation of red color whereas rays with half that wave length seem violet Between these lie all the other colors of the rainbow—the visual spectrum of light The subject of light is discussed more fully in your Book of Knowledge The chapter called Light and What Makes It would be a helpful one for you to read

LIGHT WAVES TOO LONG AND LIGHT WAVES TOO SHORT FOR US TO SEE

Our eye fails to notice any rays of longer wave lengths than that of red and none shorter than the violet rays nevertheless such rays exist The chart of the whole electromagnetic spectrum shows you that the infrared rays which our skin can feel as heat rays are waves just like light but with wave-lengths many times longer, up to one third of an inch

At the other end of the visible light band there is the ultraviolet region with wave-lengths down to one half a millionth of an inch To produce these very short very high frequency waves much greater disturbances of the atoms are required than are necessary to cause infrared or visible light The enormous temperatures on the sun for instance make possible the creation of such high frequency, short wave-length radiation in great amounts Ultraviolet radiation from the sun is so great that all life on earth would be destroyed by it if the earth's atmosphere did not protect us Luckily most of the ultraviolet rays are absorbed by a layer of ozone gas twenty miles above the earth!

ELECTRIC AND RADIO WAVES

Electric and radio waves travel with the same speed as infrared visible and ultraviolet rays that is 186 000 miles per second Like the light rays the electric and radio waves are capable of being reflected refracted diffracted and polarized But as their name implies these waves are produced by electric currents surging back and forth in man made electric gadgets Depending on whether the frequency of these currents is low or high these waves may have wavelengths of many yards (radio waves) or down to a fraction of an inch (television and radar)

THE X RAYS THAT START FROM THE INNER SHELLS OF ATOMS

Let us now turn to the electromagnetic waves with even shorter wave-lengths than ultraviolet light—the X rays and gamma rays To create X rays it does not suffice to disturb the outer electrons of atoms we have to shoot very fast electrons from a special electron source into the inner orbit of an atom of some material like copper or tungsten This will knock out one of those inner electrons such a catastrophe near the nucleus results in emission of a very powerful photon The rays formed by these photons may have wave lengths only $\frac{1}{100}$ the length of ultraviolet waves and you remember how short those are But the X rays have tremendous energy They can pass through many substances that stop light rays They can cause some chemicals to fluoresce and photographic plates to become exposed. Thus we are able to examine indirectly the inside of many objects The dentist takes an X ray picture of your teeth, for example The rays go right through the hard enamel and show in the picture the condition of the inside of the teeth

THE GAMMA RAYS THAT START FROM THE NUCLEUS OF THE ATOM

Even shorter and more powerful than X rays are gamma rays (γ rays) To get these we must produce disturbances inside

the very nucleus of atoms! In your imagination watch an atom breaking up owing either to radioactivity or to bombardment with high speed particles It is possible that a neutron in the nucleus may split up into a proton (positive) and an electron (negative) In such a violent separation into two particles a large amount of energy is released as photons—and these form the gamma rays Their wave length varies according to the nucleus from which they come The energy contained in such rays is so great that some gamma rays are able to split nuclei of heavy atoms just as high speed neutrons do That is a remarkable thing—for the photon represents pure energy while the neutron is a real particle

Incredible though it may sound gamma rays are also produced when units of negative electricity (electrons) collide with tiny units of positive electricity (the positron particles) Pair by pair these two kinds of particles completely annihilate each other, and in their stead remains pure energy in the form of photons of the gamma rays And conversely if a gamma ray be stopped by a heavy metal it may happen that the photons of the ray break up into pairs of electrons and positrons! Thus in watching the behavior of these rays and particles we realize that we can not make a very clear distinction between particles (matter) and photons (energy)

BETA RAYS AND ALPHA PARTICLES

As you know the nucleus of an atom is ordinarily composed of only two kinds of particles, positively charged protons and equally heavy but uncharged neutrons But when atoms disintegrate (break up) various rays can be emitted (sent out) from the nucleus which may consist of particles that must have been produced there during the disintegration In telling about gamma rays we said that a neutron inside the nucleus might split into an electron and a proton When this happens to many atoms at the same time, the photons are sent out as gamma rays and the electrons too are emitted at high speed from the nucleus Such electrons form beta rays (β rays) Radium for instance emits beta rays which are high speed electrons as well as gamma rays Radium also emits alpha rays (α rays), which are streams of big and powerful particles each a combination of two protons and two neutrons It becomes evident from this that the structure of an alpha particle is identical with that of a helium atom nucleus.

These alpha particles fly out of the radium nucleus at great speed Like beta rays or other charged particles, the path of alpha rays can be bent by a powerful magnet. But photons, like those of gamma rays or light can not be turned from their straight course by magnets In fact, this experiment with a magnet is usually the test made to see whether a particular ray is made up of charged particles or of pure photons

OTHER RAYS EMITTED WHEN ATOMS BREAK UP

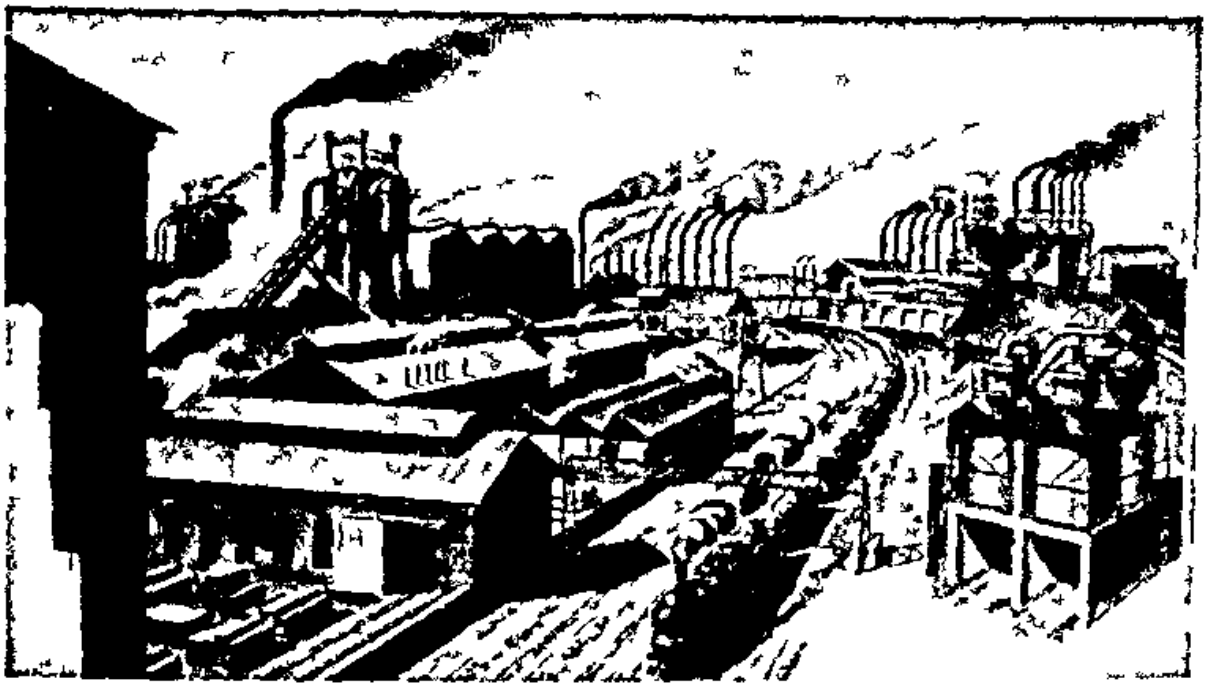
Besides α and γ-rays, the other rays that sometimes are emitted when atoms break up are made up of traveling neutrons protons positrons and deuterons Positrons are just like electrons except that they are positively charged A deuteron is a particle composed of one proton and one neutron That is its structure is like that of the nucleus of the 'heavy' hydrogen isotope deuterium

THE MYSTERIOUS COSMIC RAYS

Lastly let us look at the mysterious type of radiation called *cosmic rays* It has been known for a long time that our earth is being bombarded from the outer world (the *cosmos*) with rays so powerful that they will go right through many feet of lead Instruments have recorded them at the bottom of deep lakes and in mines inside great mountains We can not escape these rays

Yet despite many years of work by some of our greatest physicists we do not know with certainty whether these rays are particles like β rays or photons like γ rays Balloons sent up high with instruments have brought back final evidence that the strong magnetic field of the earth bends the rays even at great heights—which seems a particle-like behavior for these cosmic rays But just how large the particles are and what their charge, we still can not tell Also, these rays seem to have some photon rays mixed in with the particles If there are such cosmic photon rays they must be of even shorter wave length than gamma rays We know that because they have so much greater energy than the gamma rays

How and where cosmic rays are created is still an unsolved riddle—perhaps waiting for explanation by some future young scientist who once received his first stimulation for investigating the mysteries of our world by reading the pages of this book.



Courtesy The Fleet Supply Ship Building Company

THE DISTRIBUTION *OF* WEALTH

By **Graeme O'Geran**

ECONOMICS is the social science concerned with the production consumption *exchange and distribution of wealth* In the article beginning on page 104 you read that four things go into the making of wealth —land labor, capital and management by the enterpriser These are called the factors of *production* Now we shall *learn how* all this produced wealth is shared by those who labor, those who own land those who own capital and those who bring together land labor and capital and set them working This is the *problem of distribution*

In some cases a man labors on his own land and uses only his own capital There are many small farmers who are in this position Such a man gets his living from tilling land for himself and his capital consists of his buildings his tools machines seeds and livestock In such a case the worker is at the same time the owner of the land a worker on it, an investor of capital and in addition an enterpriser because he supplies all the managing ability which is put into the work Thus as combined worker landlord capitalist and enterpriser he takes for himself the entire product

There are many other occupations in which a single person may be at once worker landlord capitalist and enterpriser For example a cobbler or cabinetmaker may work for himself in a little shop which he owns using likewise tools and materials bought and paid for by himself In such cases there arises no problem of distribution or sharing of profits.

Almost everyone was in this group before the Industrial Revolution of the nineteenth century which resulted in great changes in production methods New heavier and more expensive machines were invented for spinning and weaving which only the wealthy could buy and install in especially constructed buildings No longer could the peasant and his wife work with a profit the old fashion spinning wheel and loom in their own little cottage It became necessary for them to go to the "factory" There they had to learn how to operate the machines and they had to work for wages No more did they own the work of their hands What they created belonged now to their employer But in giving up their independence as workers they also gained some advantages So it became common for the mass of the people to own neither the machinery

(capital) nor the land on which it was housed and they depended upon wages in return for all they had left to sell—their labor

Today a factory may be built upon land owned by another and rent is paid to the landlord The enterpriser then hires labor to work the machines in return for wages

As we already know different names are given to the shares of the produce going to the workers the landlords the capitalist and the enterprisers

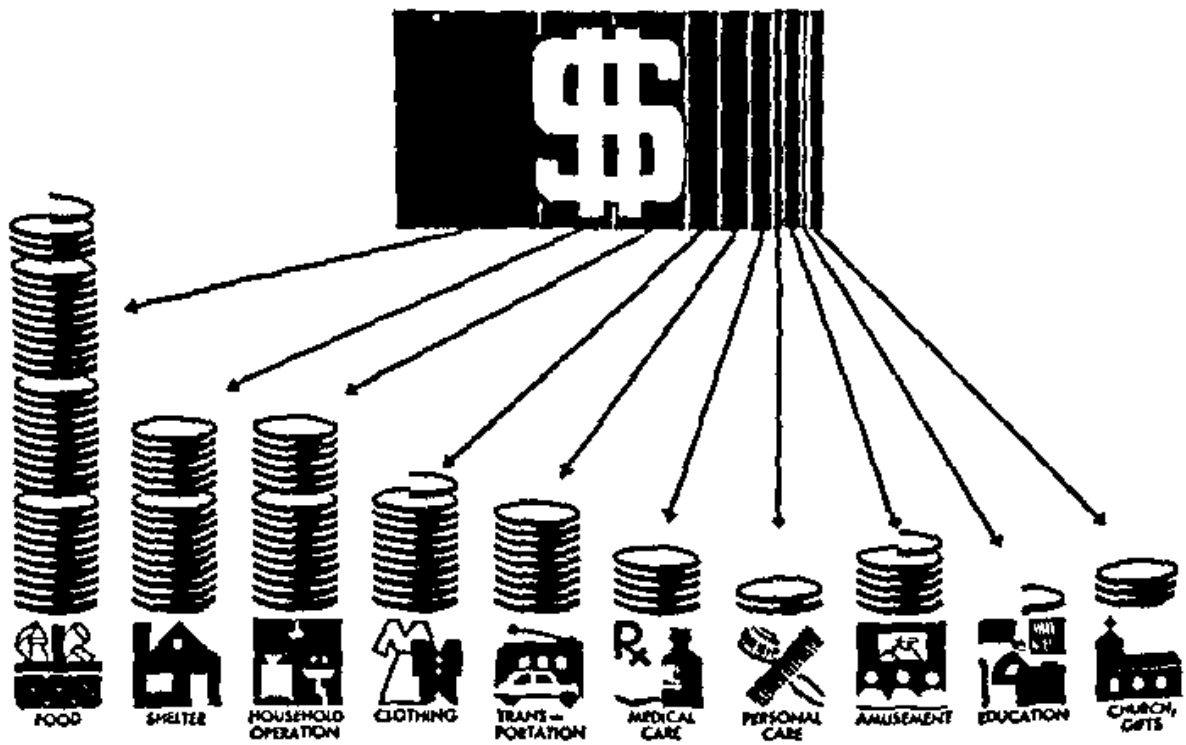
Wages and Salaries Wages are the most important single source of national income Of the 140,000,000 people in the United States around 60 000 000 work for wages or salaries in return for their share in the production of goods or the rendering of services There is no important difference between wages and salaries Wage is the term applied to the payment made on a daily or weekly basis but when payment is based on a longer period of time as a month or a year it is usually known as a salary

Kinds of Labor It is common for economists to classify labor as either physical or mental Those relying mainly on physical effort are naturally in the first group that of physical labor This group is itself divided into two groups the skilled and the unskilled The automobile mechanic and the electrician are for example, classed as skilled workers while the pick and shovel worker is unskilled

The mental workers fall into either the routine group or the inventive group The routine worker such as the bookkeeper or the store clerk having once mastered the routine duties of the job is rarely called upon to use judgment or imagination Those belonging to the inventive group are relatively few in number—of this type would be the accountant the business executive the school principal and inventors Outstanding names in this class are those of Thomas Edison Henry Ford H G Wells and Albert Einstein

Rent Rent is the share going to the landlord in return for the use of land or some other free gift of Nature In a great city where almost every foot of land is in use it is very difficult to distinguish gifts of Nature from the work of men In ordinary speech therefore we come to use the word rent as applying to any payment made for the use of land and what is built on it The true "rent however is not this total payment

WHERE A TYPICAL FAMILY DOLLAR GOES



Each coin represents one penny

from HOW WE SPEND OUR MONEY Public Affairs Committee, Inc

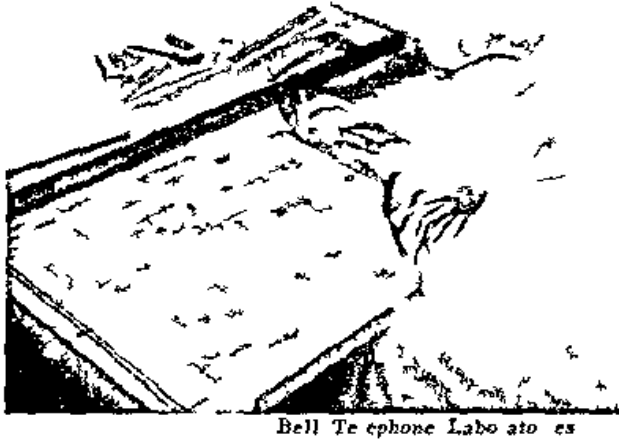
PICTOGRAPH CORPORATION

but only that part of the payment which is made for the natural piece of land

At first such a distinction may seem unimportant, but that is not really so Let us consider the rent of a store on a main street in a large city, and the rent of a similar building in some small village The village store rents for much less than a similar building in a large city Why? The real reason is *location* The city building is situated on a busy street and has so many more people passing by it than the one in the village than the shopkeeper can sell many more things in the same period of time in the city than can be sold in the village shop Therefore the city merchant is very willing to pay a higher rent You can now understand why in the large city the five and ten cent stores are to be found at the busiest intersections They are in the high rent" area but the high rent is justified by the amount of business done *Thus the economic rent is the price of the natural advantage of one site over another*

How Rents Are Affected by Natural and Other Conditions So it is in farming If a farm has poor soil or is poorly situated it yields less in produce or costs more to get its produce to market than a farm with rich soil or one that is well located So we see how some landlords may be able to obtain a high rent while others can get only a small one

Let us say that a particular farmer plants the same amount of corn on two equally well cultivated pieces of land of indentical size located five miles apart However in spite of identical care the farmer finds at harvest time that one piece of land yields twice as much corn as the other Assuming as we have that all growing conditions were the same on both plots of ground, the great difference in yield can be due only to the difference in the quality of the two pieces of land Rent charged for the surplus grown on the better grade of land is given the name of *economic rent*



Bell Telephone Laboratories

Draftsmen are "mental" workers Drawings for blue prints must be in perfect scale and show precise measurements.

Some land may be especially valuable because there are minerals under the surface If coal or oil is discovered at a certain spot mines, wells and factories will spring up on acres that were formerly worthless Houses and shops will be built near by to serve the people who will flock to the area Thus because of the natural resources the land round about will become valuable and will command a higher rent

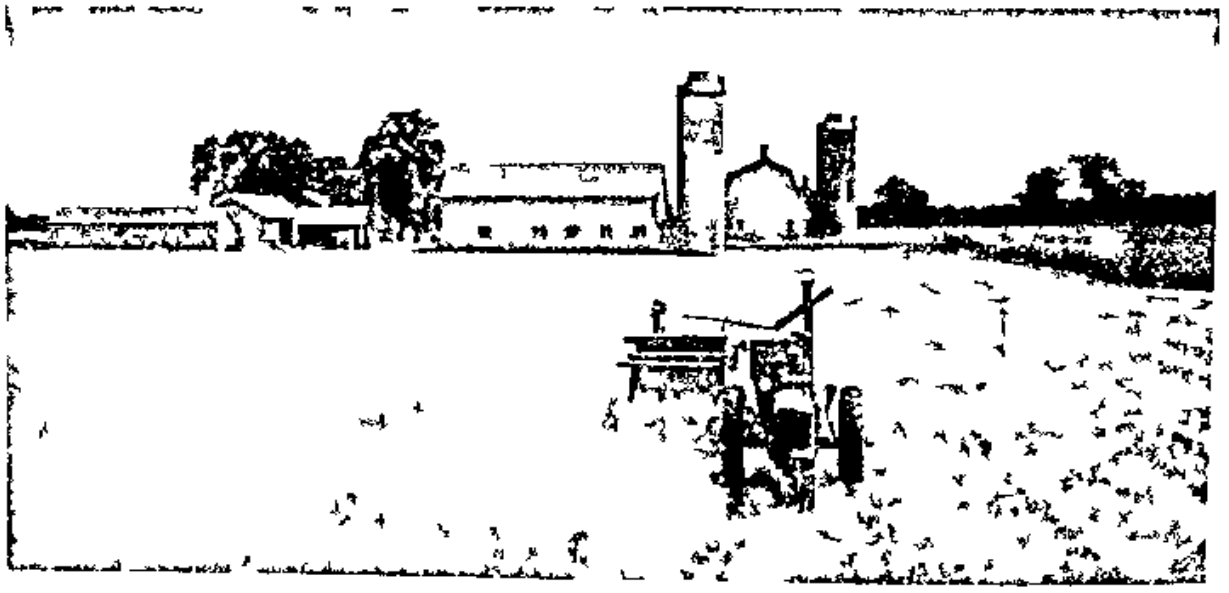
Again if a railway is built through an area rents will be raised This is because people have been brought to the area and they have created a demand for houses In the early days of railroad building some landlords strongly objected to them and tried to prevent the railroads from passing near their properties When such men succeeded in their effort, they robbed themselves of rent without knowing it

Capital and Interest People who save money (capital) may either use it to pur



FSA photo by Vachon

This grocery store is in the proprietor's home which he owns; and since he does all the work himself, on his own capital, he is worker landlord, capitalist and enterpriser in one.



With good soil and location this farm brings a high rent



Rese cmen \dm n s a on p o o by Ro hste n
This run-down desolate farm brings only a low rent

chase things which directly satisfy their own wants or loan it to others who wish to make use of it Most money so loaned is used by business organizations for production purposes Money so loaned is called capital This money goes directly into tools buildings and machinery which are the real capital of course Now when a person saves money and loans it out he can not use it himself and so a return for the loan is necessary to pay for the sacrifice That is why money loaned must be paid for This return for the loan of capital is called interest and is a reward for waiting

There is some risk in an investment of this kind When for instance your father loans money to the government—that is buys a bond—he knows there is no risk He will receive not only interest but also the return of his money when the bond comes due Money lent in good security to an old established business firm runs some risk though a small one So it is with money lent on the security of a mortgage as it is called of good buildings where the lender's security is based on the fact that if he is not paid he may seize the buildings In such instances the capitalist (the one loaning the money) has a claim on tangible property which the courts will turn over to him if the loan is not repaid according to its terms

If Everyone Who Saved Money Wanted to Keep It Quite Safe, There Would Be Very Little Enterprise It is just because some people are willing to take risks on the chance of being paid for their risks that capital comes to be invested in business enterprise However, enormous sums are often lost by those who take such risks

Profits You have learned that before the Industrial Revolution the factors of production were not separately owned Then it was usual for one man to own the land providing his own labor and capital in order to produce whether he were a farmer cobbler or weaver or any other kind of worker

However, with the coming of machinery all this changed One person would have labor to sell another would have land to rent and still another would have capital to invest

To whom did the people go who had these factors to sell? They went to a fourth and new factor which had come into being—the *enterpriser* or business man His task it was to bring together the other factors

of production in proper proportions, in order that production might be efficiently carried on It is the enterpriser then who assumes the risks for the success or failure of the enterprise He must make the decisions as to the amounts of land, labor and capital necessary in a given plant or business unit

Who is the enterpriser today? Technically he is either the single proprietor who provides all the land, capital and labor himself or the member of a partnership or the stockholder in a corporation, or the business executive who directs the destiny of a great organization such as United States Steel or General Motors The degree of risks involved varies greatly among these individuals In every case some risk is present and therefore each of these men is an enterpriser The term enterpriser, however, is popularly applied to executives of large corporations

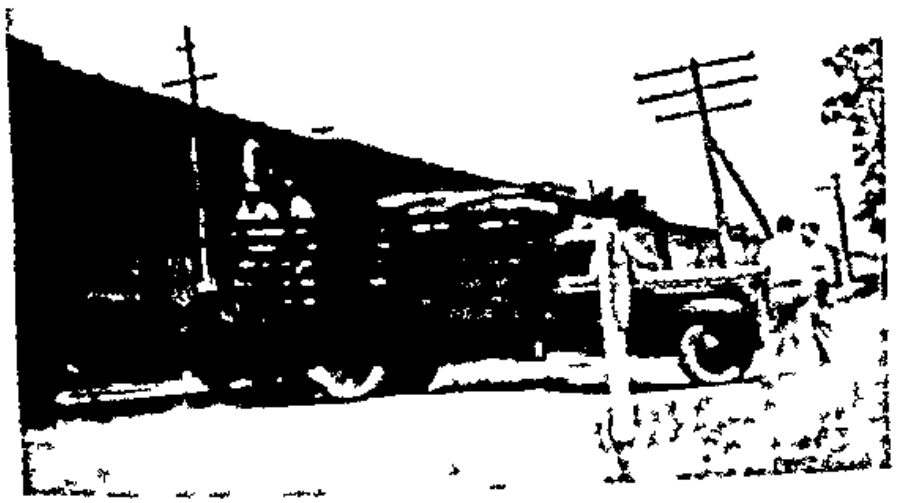
In return for assuming these important responsibilities and the risks involved the enterpriser is rewarded with *profit* Profit is what is left after the costs of doing business are deducted In the case of the single enterpriser, the man must pay to himself what it would have cost him to rent land, hire labor, supply capital and pay a manager These are production costs Anything left over is *profit* In the partnership what is left after paying expenses is divided up among the partners as profit In the corporation it is paid out in the form of dividends on stock

To the economist and business man there are two kinds of profits (1) *Necessary profits* are those required to give a man sufficient incentive to work as director of a business or industry This incentive must at least equal what the man could earn by hiring out as an employee to some other enterpriser Strictly speaking necessary profits are the *wages of management* (2) *Pure profits* are those remaining after the enterpriser pays his labor rent on the land return on capital invested in the business and necessary profits—all costs of production To win these pure profits of course is the aim of all business men However for business as a whole they are none too plentiful Neither are they guaranteed They may be plentiful in good times but may disappear in periods of depressions In such times even necessary profit may not exist

How the Distribution of Wealth is Determined The proper distribution of wealth between labor's share (wages and salaries) the landlord's share (rent) the capitalist's share (interest) and the enterpriser's share (profit) is a very difficult matter to decide In the main the distribution of this wealth is determined by the action of the laws of *supply* and *demand*

How Rent Is Determined Demand and supply affect rent as they affect prices of anything else, such as shoes or baseballs If many people must live in one place they all demand houses and therefore there is a big call for land at that place This demand raises the price of the land or the rent paid for the use of it

Is it possible in such a case to increase the supply of land to the people who want houses? Yes it is possible If a building of many stories is put up more people can live on the land than if a building of only one or two stories is erected A railway or a bus line can make it possible for people to



Rural Electric Power

Electricity on a railroad increases the value of a farm, as the crops can be sent to market or home more quickly and more cheaply



Bo h pho os by Harry Ru enste n from ILGWU s Just ce

Confe ence between wo kers represented by union officia s and em ployers (enterprisers) on wages

In the clothing industry a Price Settlement Bu reau run by both the union and management examines garments to d c de rates of pay



live far away and quickly ride back and forth to work In this way the homes of the people are scattered and in effect a larger supply of land becomes available for them in which case the rent at the busy spot may fall

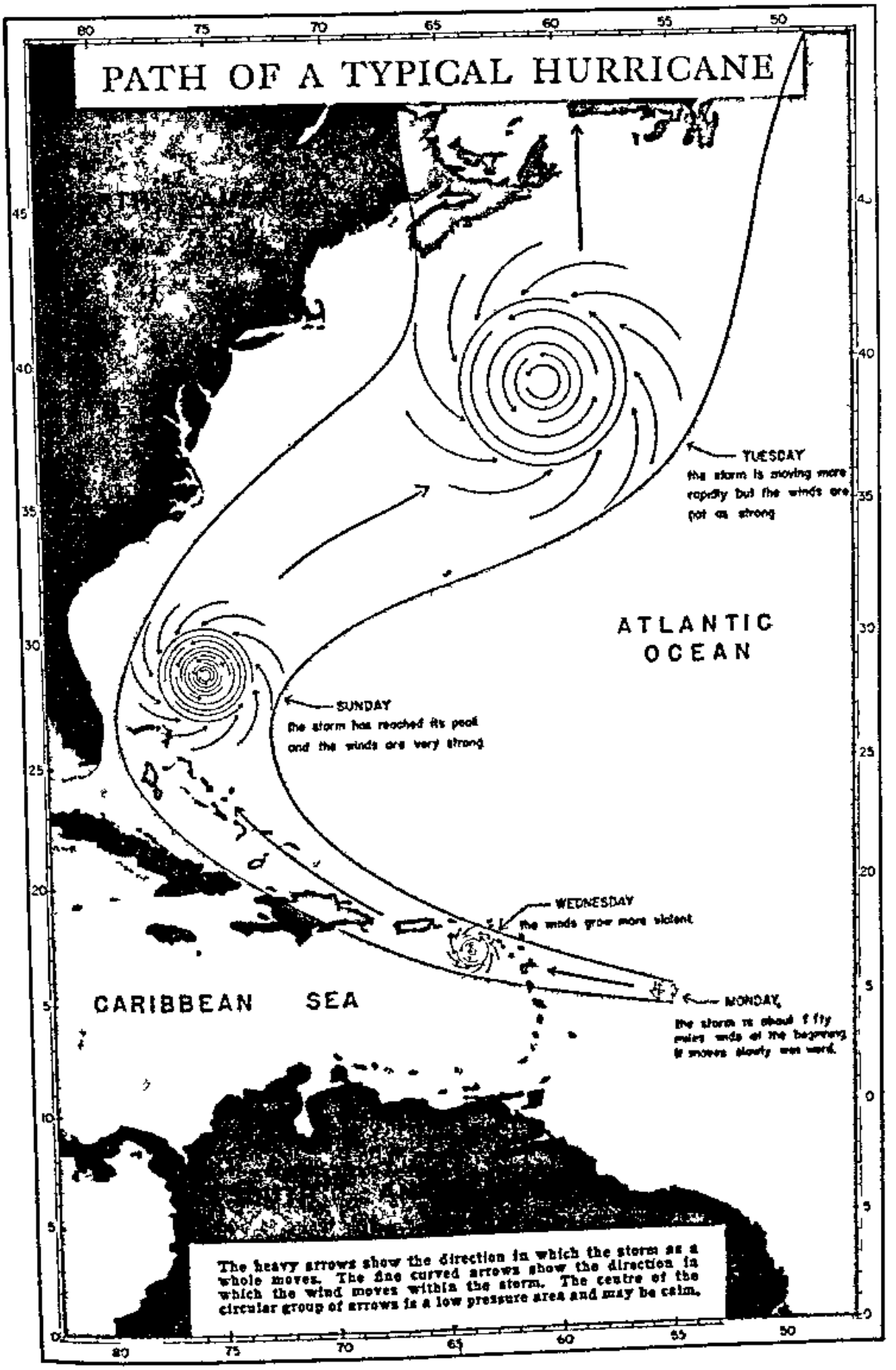
How the Return to the Cap talist and the Enterpriser Are Determined As in the case of the return to land and to labor supply and demand largely determine the share of national income going to the capit_list and to the enterpriser If for example as the result of an invention a new and success ful business is created more cap tal and managerial ability are required To secure this necessary capital through the sale of bonds high interest rates will be paid and the hope of greater profit will lure the enter priser to associate himself with the new proj ect This was exactly what happened in the early days of both the automobile and mov ing picture industries But as more and more capital entered the field and larger numbers of enterprisers sought the rich rewards the supply of both these factors began overtak ing the demand As a result today the in terest and dividends paid by these indus tries are about on a par with those paid by other major bus ness enterprises

How Wages Are Determined We saw in studying prices in general how the demand for goods really means the demand for goods at a certain price The demand for workers in practice means demand for workers at a certain wage

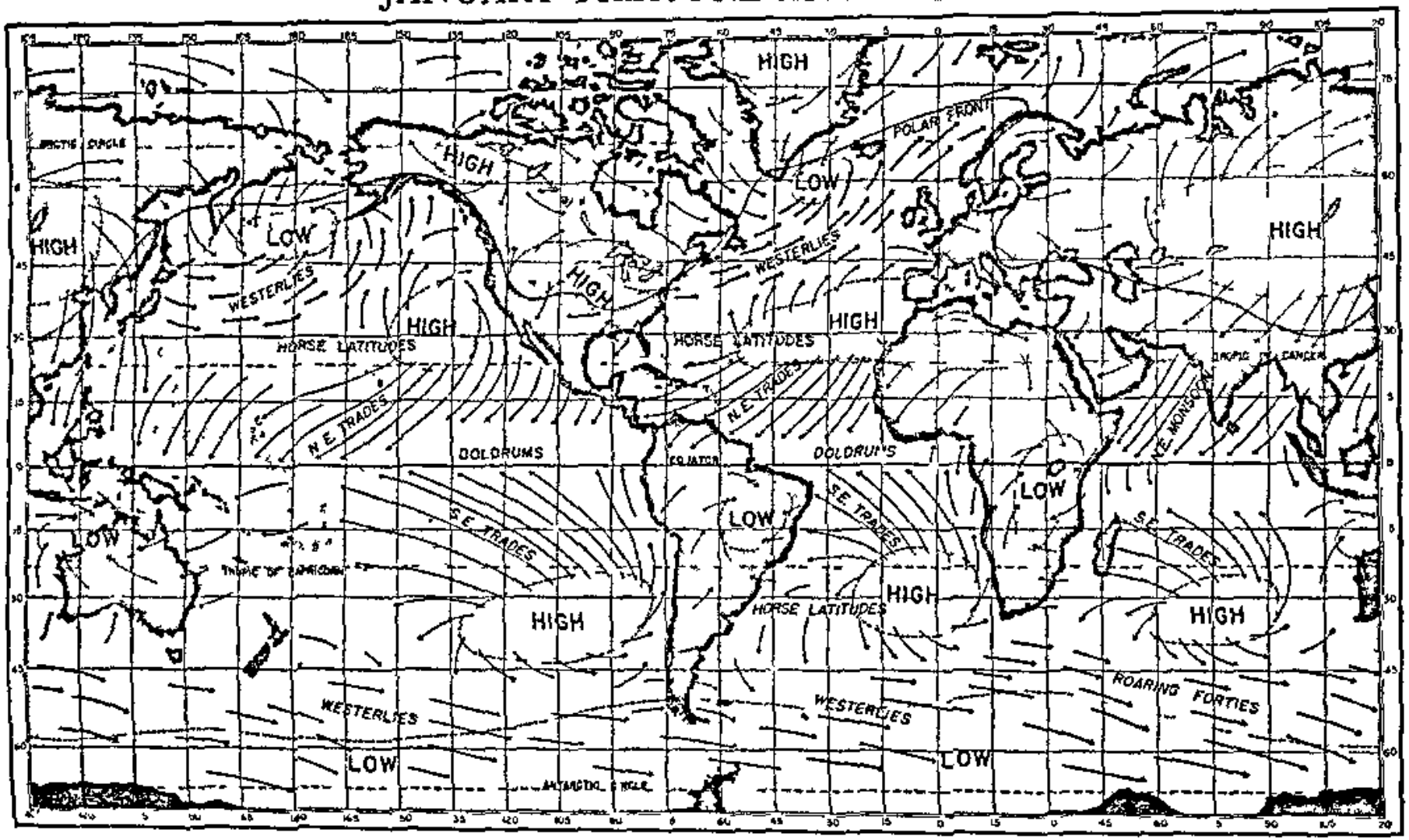
The employer can not pay more than a certain wage at any particular time unless he can get greater production from the same number of workers If still more money in wages is demanded he can not pay it and he has to go out of business

The supply of labor in a trade also gov erns the price of labor If for example a large number of workers seek jobs in an automobile plant that already has all the laborers it needs the employer may be able to reduce wages upon threat of dismissal This gives the enterpriser an advantage over the worker which can be mod fied only by good feeling and justice or by the workers unit ng

The labor union is a society of workers banded together to secure for themselves the h ghest wage which the profits of their trade allow The union if it does its duty will see that its members are not underpaid and yet it will not be so foolish as to demand a wage higher than the industry can pay However, just as the employer is often a bad judge of the justice of his own case so the unions are not always wise or fair in their demands upon the employer Thus occasional quarrels arise about the distribution of wealth, and there are strikes and lockouts


PATH OF A TYPICAL HURRICANE
TUESDAY
the storm is moving more rapidly but the winds are not as strong
ATLANTIC OCEAN
SUNDAY
the storm has reached its peak and the winds are very strong
WEDNESDAY
the winds grow more violent
CARIBBEAN SEA
MONDAY
the storm is about fifty miles wide at the beginning it moves slowly westward.
The heavy arrows show the direction in which the storm as a whole moves. The fine curved arrows show the direction in which the wind moves within the storm. The centre of the circular group of arrows is a low pressure area and may be calm.

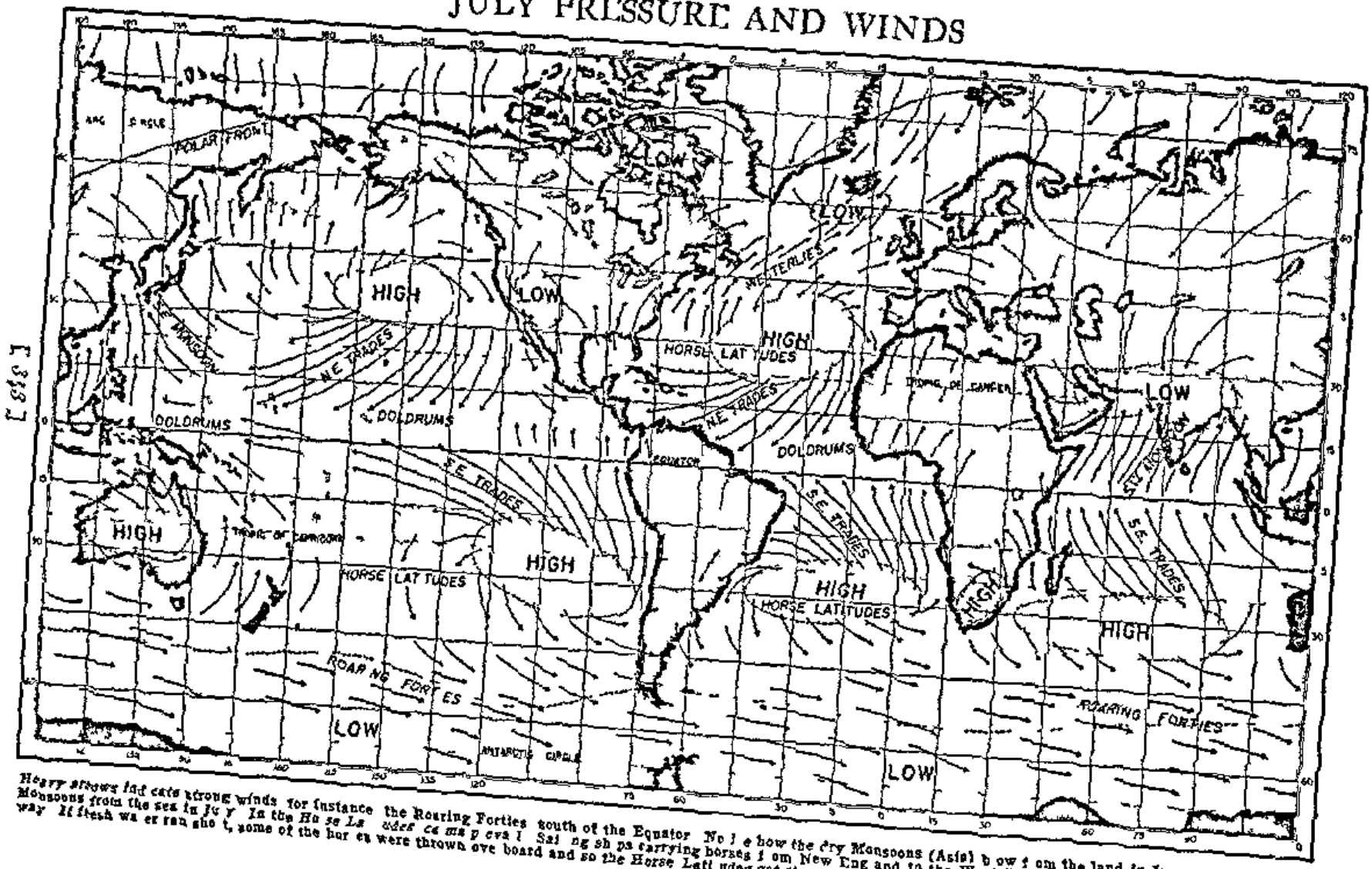
JANUARY PRESSURE AND WINDS



[312]

Low- and high pressure areas and prevailing winds in January The Polar Front line shows the average southern limit of the cold North Polar Maritime and Polar Continental air masses. In North America this extends to about 35 degrees north latitude In July (see the chart on the next page) the line does not dip below the Arctic Circle in North America. Near the Equator are areas of calm, or of feeble winds, known as the Doldrums from an old word meaning dull.

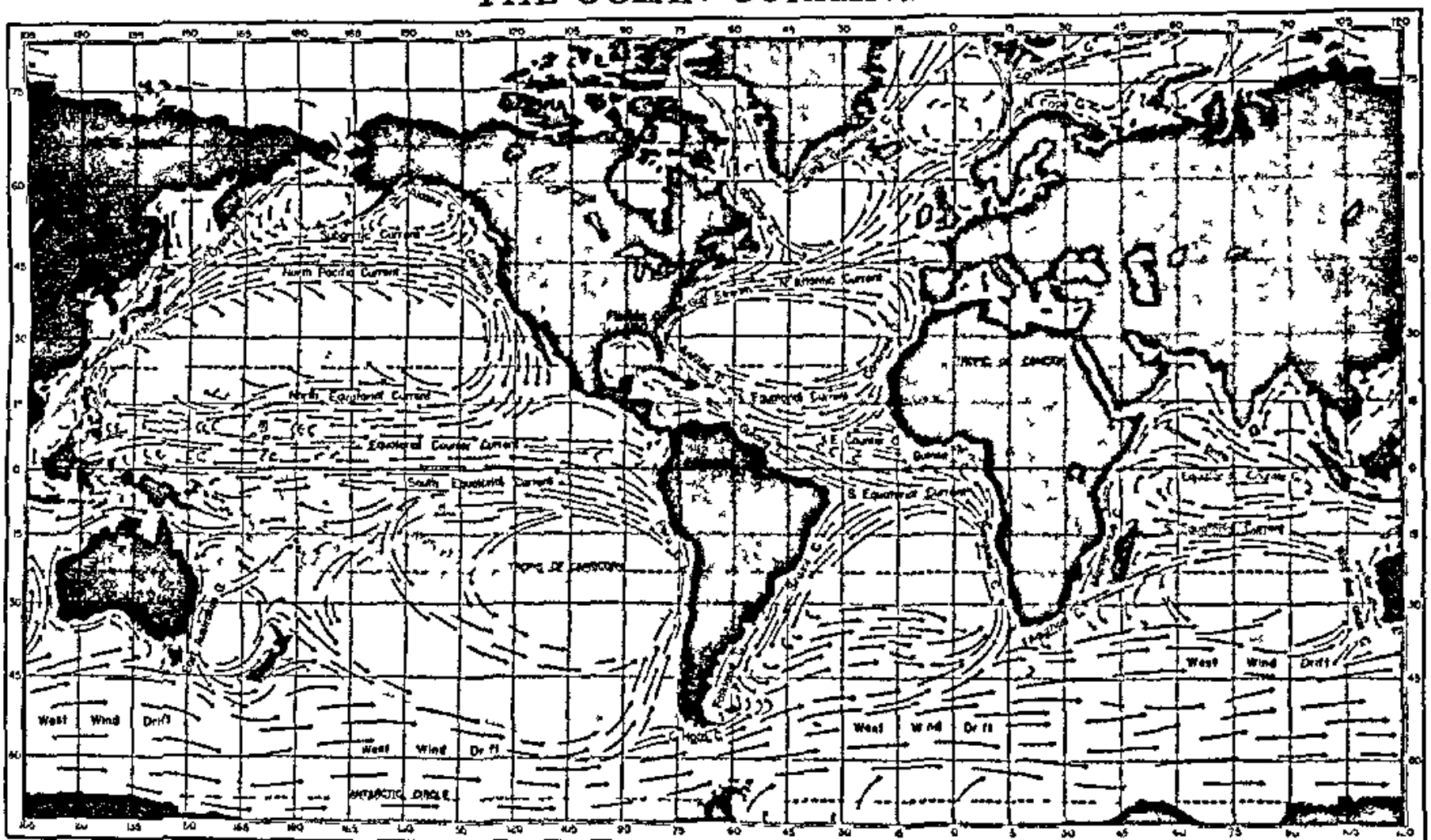
JULY PRESSURE AND WINDS



[318]

Heavy arrows indicate strong winds, for instance the Roaring Forties south of the Equator. Notice how the dry Monsoons (Asia) blow from the land in January and the wet Monsoons from the sea in July. In the *Horse Latitudes* calms prevail. Sailing ships carrying horses from New England to the West Indies were sometimes becalmed on the way. If fresh water ran short, some of the horses were thrown overboard and so the *Horse Latitudes* got their name.

THE OCEAN CURRENTS



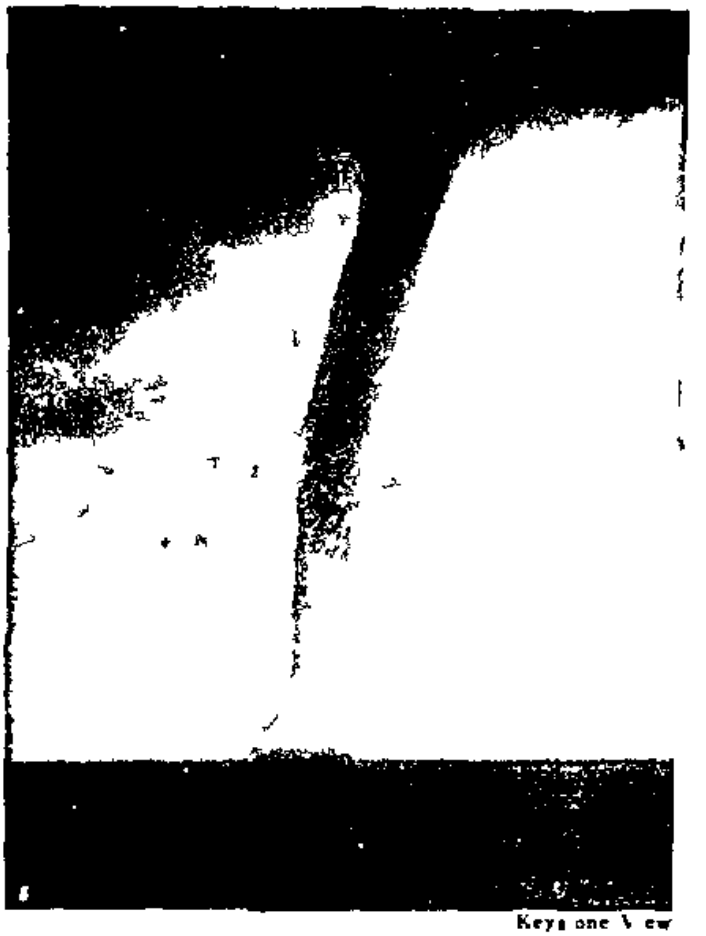
This map shows the ocean currents. The parts of oceans that are light-colored in this map have cold water they are as you see, in bands north and south of the warm waters (dark-colored) Trace the Gulf Stream, the Labrador Current, also the Peru and Falkland currents which move up the coasts of South America. The double arrows ⟷ show the Monsoon drifts near Asia which reverse their direction in summer and winter See the wind charts on pages 6026 and 6027

WINDS *and* OCEAN CURRENTS

By

Frederick Fuglister

Woods Hole Oceanographic Institution



Keystone View

The tornado "twister" over the ocean is called a water spout.

METEOROLOGY is the science of wind and weather For centuries man has wondered where the wind comes from and where it goes. *Certain things about the wind were* easily observed for instance it was known that in some localities it would blow from the southwest most of the time during the summer and that when winter came it would just as surely blow from the northwest But even in such places it was uncertain the wind in midsummer might on any day come from any direction or there might *be no wind at all*

Men looked at the sky at the clouds and at the sun and moon for signs of what weather to expect If many times they saw a certain cloud formation before the coming of a strong northwest wind then naturally they associated that cloud form with that wind To people in *all walks of life* a knowledge of what the winds are going to do has been of very great importance Will the wind that blows tomorrow be cold or warm? Will it bring rain or snow or sleet? Will it blow so hard that it damages crops and buildings? Before answering any of these questions before attempting to forecast the weather, man had to answer one question

What causes the winds to blow?

Before talking about the causes of the winds let us make sure that we understand all the words used in the explanation We can cover only a tiny part of the study of winds which is part of the science of meteorology, but even so we must be scientists enough to use our words accurately To begin with what is wind? It is simply air in motion *and air is a mixture of gases and water va*por with very very small drops of water and dust floating about in it

Though the air actually moves in all directions upward and downward as well as horizontally it is only the horizontal motion which we commonly call wind It is still wind strictly speaking when it goes up or down but these motions are called up-drafts and down-drafts The direction horizontally is always expressed as *the direction from which the wind blows* Usually the compass points are used For instance a northwest *wind is air coming from the northwest* toward the southeast a south wind is one coming from the south and blowing toward the north When we wish to show a winds direction on a chart we draw an arrow which points in the direction in which the wind is going

The motion of the air is measured in many different ways such as feet per second or miles per hour as we measure the speed of a car, or in knots as we measure the speed

of ships or with the Beaufort scale which is numbered 0 (representing calm) up to 12 (representing a hurricane) It is difficult to measure the exact speed of the wind since the air usually does not move steadily and the speed varies a great deal depending on how high off the ground it is measured

The primary cause of the wind is the heat which the earth receives from the sun This heat strangely enough does not warm the air very much as it passes through on the way to the ground The air receives most of its warmth from the heat that radiates back from the earth's surface Some parts of the earth's surface radiate heat more readily than others The land radiates more heat to the air than does the water Also as the earth revolves about its axis and moves in its orbit around the sun it receives more or less heat on various areas of its surface according to its position When it is cold in the Northern Hemisphere it is warm in the Southern When it is day on one side of the world it is night on the other

So since the area heated is constantly changing winter and summer day by day the difference in temperature between one place and another is also changing As we shall explain the changes in temperature cause the wind to shift its direction and its speed However in spite of their seemingly erratic behavior the winds on the average do follow set patterns

When air is heated it expands This means that the same amount of air takes up much more room when it is warm than when it is cold Therefore any given amount (a square foot for example) of warm air weighs less that is exerts less pressure on its surroundings, than the same amount of cold air This low pressure air rises to the upper atmosphere and there spreads out This increases the pressure in the surrounding areas When the pressure is high the air sinks and spreads out across the surface of the earth It is this last movement of air across the earth's surface that we know as the winds

Most air is lighter than dry air, so we call an area that contains warm moist air a *low pressure* area and one that contains cold dry air a *high pressure* area To measure this pressure of the air, the meteorologist uses an instrument called the barometer We generally refer to these pressure areas as simply *High* or *Low*

If you look at the Wind and Pressure Charts of the world pages 342 and 343 you will see that the wind-direction arrows point out of the high pressure areas and into the low pressure areas

But you will say why do the arrows curve? None of them goes straight from a High to a Low You are right The reason for this is the movement of the earth about its axis As the air moves from a high pressure area to a low pressure area it is forced to the right in the Northern Hemisphere and to the left in the Southern Hemisphere This curving of the wind as it goes into a low pressure area is known as a cyclone or a cyclonic wind The wind is a strong one if the drop in pressure is great The movement of air out from a High is called an anticyclone You can see that in the Northern Hemisphere a cyclonic wind moves in a counter clockwise direction and clockwise in the Southern Hemisphere (Clockwise means the way the hands move on a clock, counter clockwise of course means the other way round)

The word cyclone has two meanings It is the name given to certain tropical storms but for the meteorologist it describes the movement of air into a low pressure area and it may be a violent storm or it may not Sometimes a low pressure area is quite large

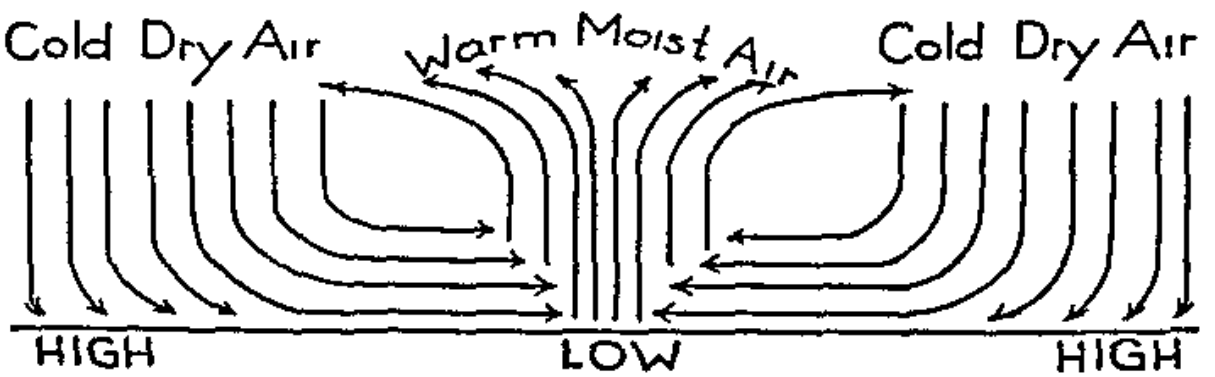


Figure 1 How the air moves from a high to a low pressure area Warm moist air rises and spreads out. Cold air (which is heavier) sinks and spreads out below The diagram is very much exaggerated



Figure 2. Wind in the Northern Hemisphere 1) Arrows point out of high pressure into low pressure areas 2) The earth s rotation causes winds to curve (a cyclone) 3) Counter-clockwise cyclonic motion in Northern Hemisphe e

more than a thousand miles across in which case the winds may not be very strong

If the earth s surface were all one ma terial (if it were covered with water for in stance) then the wind systems would be comparatively simple Around the world at the Equator there would be a belt of low pressure since that area receives so much direct heat from the sun Both north and south of this belt there would be belts of high pressure because the warm rising air of the Equator would spill over increasing the pressure on either side Next in the sub-arctic and subantarctic there would be belts of low pressure with strong winds And last there would be high pressure areas due to the cold at the two Poles The winds would then blow in the di rections shown in Figure 3 The belts of low and high pressure would move north and south with the seasons north during the Northern Hemi sphere s summer and south during the win ter

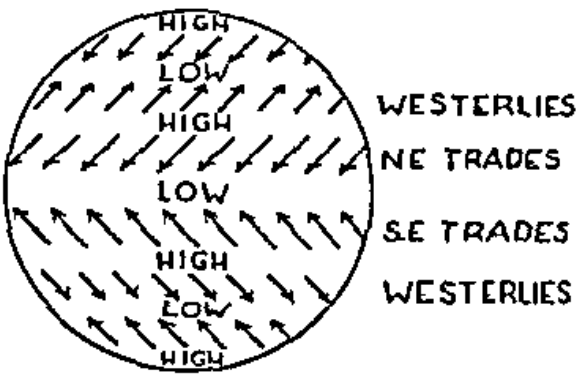


Figure 3. The regular pressure belts we would have if the earth were entirely covered by water

As a matter of fact since by far the great er part of the earth s surface is covered by water the wind sys tems are something like those on our imagi nary water-covered globe The northeast and southeast trades do blow consistently toward the Equator we do have a region of prevail ing westerly winds But the only one of these wind belts that extends completely without interruption around the world is the belt of the westerlies in the Southern Hemisphere because in this region the surface of the earth is entirely covered with water, except for the tip of South America

During the summer months air masses that lie over the land are much warmer than those over the water (We have already said that the land radiates heat from its surface much more readily than the water The sea absorbs much of the heat and gives it back slowly) In winter therefore the air over the sea is warmer than that over the land This is especially true where the land area is large So we have a relatively low pressure area over the land in summer and a High in winter Consequently the winds blow onto the continent in summer and away from it in winter These winds are known as the monsoons The best known monsoon is the one that blows across the Indian Ocean onto the continent of Asia As with the word cy clone monsoon is often thought of as mean ing a violent storm but that is not the case The northeast mon soon that blows in winter across south ern Asia out over the Indian Ocean does not bring any rain and the winds are quite moderate

This seasonal changing of tempera ture and pressure over the continents of course plays havoc with our simple dia gram of high and low pressure belts We now see that there can not be any continuous belts of high and low pressure around the world where the belts pass over both the continents and the oceans Because of this the pressure areas and their resultant winds break up into the patterns as you see them on the Wind and Pressure charts You will notice that over the oceans the winds blow in much the same directions in winter and sum mer It is only near the land that the large changes take place with the seasons

There are two important things to remem ber when we study average wind charts

First because of the small size of the charts many winds that are very important locally are not shown Every mountain every river has its own effect on the prevailing winds A chart may show southwest winds as the summer condition in a certain large area yet because of the lay of the land there may be a valley in that area where the summer winds are southeasterly The second thing to remember is that these charts show aver age conditions That is the winds usually blow in these directions but not always es pecially not on the land areas The trade winds which are over the oceans can be expected to blow as indicated on the chart though they may be a little stronger one day than the next The westerlies in the south ern Atlantic are almost as certain and can be relied on to blow at gale force a good deal of the time during the winter

Let us now consider the storms or dis turbances as the meteorolog st refers to them A storm is a small traveling low pressure area When it starts it moves very slowly gradually increasing its speed and size until it may be as large as eight hundred miles in diameter When a disturbance has reached such proportions the winds are not nearly so strong as when the storm area was smaller The strongest winds are associated with the smallest and briefest disturbances For example there is the tornado of the United States which may last only a half hour, and measure only one thousand feet across but wh ch does considerable damage even in that short time The change in pres sure is very great in these storms and the air rises very rapidly

The polar front as shown on the Wind and Pressure charts indicates where the cold air from one of the Poles meets the warmer tropical air It is a constantly shifting front and it is along this boundary line that most depressions travel The front does not always represent a sharp change in temperature but wherever there is an abrupt change that is where a storm is most likely to be severe The polar front line on the Wind and Pres sure charts shows how the cold air moves down over the continents during the north ern winter and recedes in the summer

On the Wind and Pressure charts you will find the names given to the major wind sys tems such as the trades and westerlies You also will find the names given to those areas where there is rarely any wind at all the doldrums and where the winds are light and variable the horse latitudes Not shown or named are the northers that blow across the Gulf of Mexico in the winter the tornadoes that usually occur in the upper Mississippi and Missouri valleys of the United States and the Santa Ana in California a hot wind that blows from the desert toward the Pacific Ocean There are hundreds of other winds all over the world many of them having very strange names such as the elephanta of India the williwaws in the Straits of Magellan and the southerly buster in Australia

The names that are most familiar to us are those given to the storms The hurricane is a tropical storm that occurs in the western parts of the oceans near the Equator that is in all the great oceans except the South Atlantic Though we call this storm in the West Indies a hurricane the ones in the In dian Ocean are called cyclones those in the China Sea are called typhoons and the Aus tralians who like unusual names call the tropical storm that occurs off their northwest coast the willy willies

Almost 150 years ago a British admiral, Sir Francis Beaufort devised a method of guessing the wind s velocity This instrument is still used on ships though it is not very exact The Beaufort scale as it is called registers winds as shown below

THE BEAUFORT SCALE

Scale Number	*Speed of Wind in Statute Miles*	*Description of Wind*	*Indications on Land*
0	Less than 1	Calm	Smoke goes straight up
1	1 to 3	Light Air	Smoke drifts
2	4 to 7	Slight Breeze	Leaves rustle
3	8 to 12	Gentle Breeze	Leaves and small twigs are in motion
4	13 to 18	Moderate Breeze	Dust flies, and paper small branches move
5	19 to 24	Fresh Breeze	Small trees sway wavelets on water
6	25 to 31	Strong Breeze	Large branches move umbrellas are blown
7	32 to 38	High Wind	Whole trees move walk ng is difficult
8	39 to 46	Gale	Twigs break off
9	47 to 54	Strong Gale	Loose shingles and chimneys go
10	55 to 63	Whole Gale	Trees may be uprooted
11	64 to 75	Storm	Damage is widespread
12	Over 75	Hurricane	Anything may go

THE OCEAN CURRENTS

No one knows who the first ocean travelers were But whoever they may have been no doubt one of the first things they noticed apart from the huge quantities of water was that the water beneath them would often carry their boats from place to place even when there was no wind to blow them about Certainly the tides the rising and falling of the water along the coasts must have been known to man thousands of years ago And he soon found if he lived on a small bay or inlet, that when the tide was coming in he had a difficult time putting out to sea in his tiny boat So it was that he first learned of ocean currents But it was many more centuries before he realized that there are other and much larger currents in the oceans than those caused by the rising and falling tides

Tidal currents especially where they flow between land banks move much more rapidly than do any other of the ocean currents But tidal currents are nowhere near so large and do not travel so far as ocean currents The speed of ocean currents can not be compared to air speeds The fastest tidal currents rarely move more than 6 miles an hour This compared to known wind speeds of 150 miles an hour, is very slow indeed Yet for ships at sea even a current with a speed of one knot means something The most interesting things about ocean currents however are the direction in which they travel and the amount of water that they transport

The direction in which a current is moving is called the set of the current A northeasterly current is one setting or moving toward the northeast The speed of the moving water is expressed in knots, and is called the drift of the current A knot is equal to one nautical mile per hour (about 2 029 yards)

There are three main causes of the ocean currents giving rise to three different types of water movement The first is the attraction of the sun and moon which causes the tidal currents The second is the prevailing winds such as the trades and westerlies which through friction set the water in motion. The third cause is the heat from the sun which affects the density of the water The differences in density from one place to another cause the water to move much as the differences in air pressure cause the winds Warm water is lighter, less dense than cold water The density of sea water is affected not only by the temperature but also by the amount of dissolved salts it contains The more saline (salty) the water, the heavier or more dense it becomes

If you will look at the chart of the ocean currents you will see the names of all the major currents the arrows showing the directions in which they flow You will notice that most of the names given to the currents are simply the names of the countries by which they pass as the Brazil Current the California Current One of the notable exceptions to this custom is the Gulf Stream The name given this current brings up an interesting point

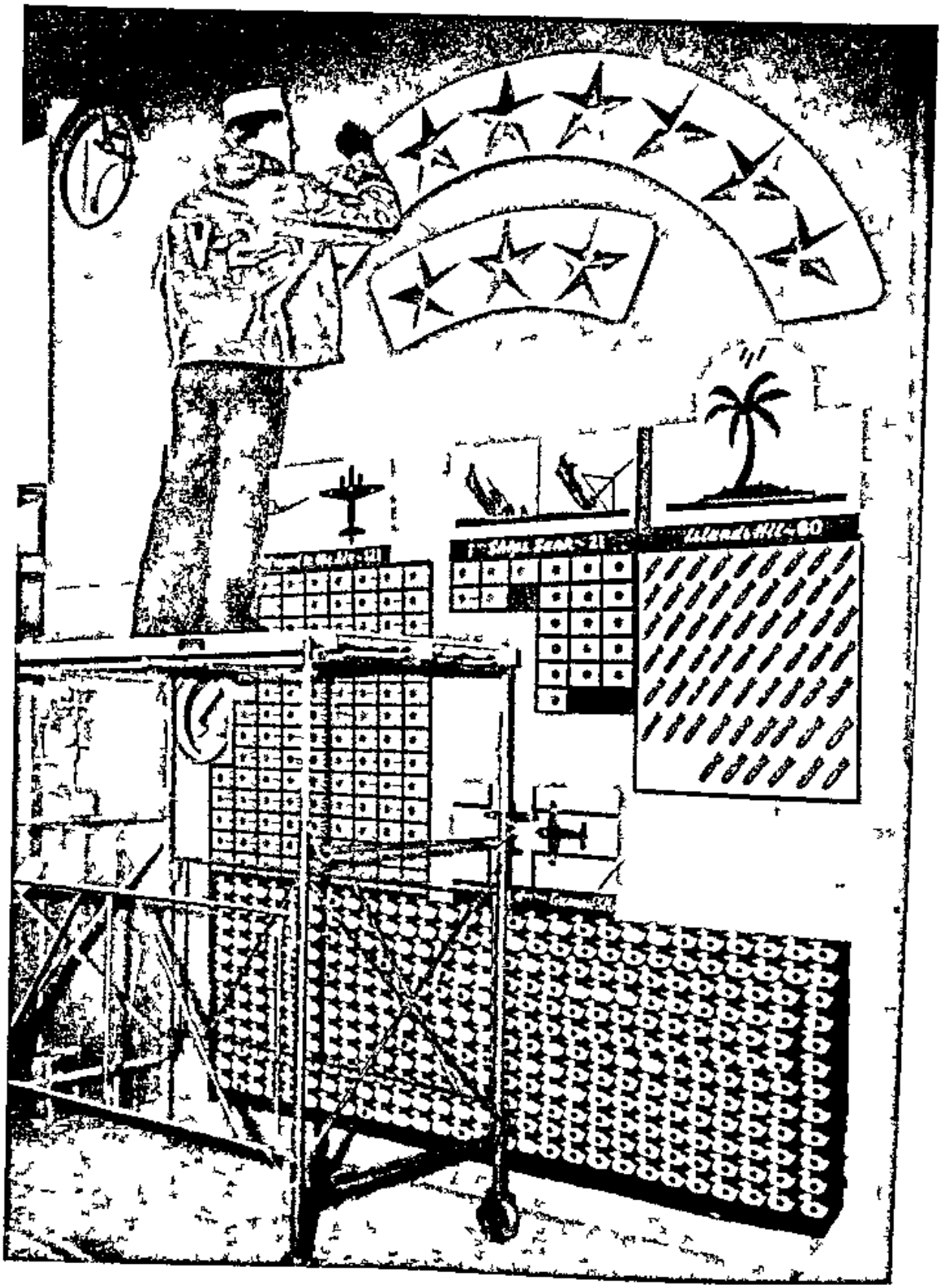
It was named the Gulf Stream because it was supposed to come from the Gulf of Mexico, but observation has shown that it has three major sources—first those waters from the Caribbean Sea which follow the shores of the Gulf second those Caribbean waters which flow directly by the north coast of Cuba and third the Antilles Current which forms part of the Gulf Stream north of the Bahama Islands

We can not point to the beginning of any of the major ocean currents The names we give them are simply for convenience in locating and pointing out the changing characteristics of the current patterns in the oceans So the system of naming currents according to where they are or by the names of the countries which they pass is a simple and convenient one

All the major ocean currents carry vast amounts of water over long distances Since water temperatures change slowly currents act as cooling or warming agents upon the land masses near which they flow depending on whether the currents come from cold or warm regions We call a current warm if its surface waters are warmer than the water through which it flows Actually if it is a deep stream a warm current may be carrying along extremely cold water well beneath the surface Except for the tidal currents along the coasts very rarely does an ocean current reach to the bottom If the current is caused entirely by the wind it will be comparatively shallow The deepest currents are those caused by changes in density of the water

The inshore tidal currents reverse their courses every six hours or every twelve hours, depending on the tidal period The offshore tidal currents constantly change their direction of flow and are often called rotary currents. The currents called monsoon drifts, caused by the monsoon winds change their course with the seasons The most important are the northeast and southwest monsoon drifts of the Indian Ocean

HOME IS THE SAILOR, HOME FROM THE SEA



Official U. S. Navy photo

The glorious record of a gallant ship on board the light carrier Monterey Frank G Schroyer Painter 2nd Class of Philadelphia is putting the last, proud touch on the ship's scoreboard of battle action. The Monterey was one of the first major units of the Pacific fleet to arrive in New York for the celebration of Navy Day



Year's Events—

1945 Calendar

A WORLD at war became a world at peace before 1945 was torn from the calendar Mechanized Allied land armies in the east and the west crushed Germany between them with the aid of the most powerful air forces in history Hitler s legions tottered even as representatives of the United Nations met in San Francisco to discuss an organization for permanent world peace

The unconditional surrender of nazi Germany was announced on May 8

Japan alone fought on China made stronger by United States aid fought back on the mainland American and British navies blockaded the Japanese main islands

In early August science threw its greatest weight into the war as an atomic bomb smashed the Japanese city of Hiroshima Nagasaki was destroyed as the second atom charge was loosed on Nippon Russia declared war and attacked in Manchuria

The Imperial Japanese Government unconditionally surrendered to the Allies on August 14

Peace became a reality and with it came many obligations Strengthening the United Nations Organization feeding and governing conquered lands and changing industry back to peacetime production were and are some of the world s problems

Foreign affairs and national events, the activities of armies and people of nations and individuals are all listed in the following calendar of the year s headline highlights

Jan 1 France joins the United Nations

Jan 3 United States First Army attacks northern flank of German salient in Belgium —General Nicholas Plastiras organizes new Greek cabinet

Jan 4 New American landings on Mindoro Island in Philippines are unopposed

Jan 5 The Soviet recognizes provisional government of Poland set up under Russian sponsorship at Lublin

Jan 6 Turkey breaks off relations with Japan

Jan 9 Americans invade Luzon Island in Philippines land at Lingayen Gulf

Jan 11 British representatives and leaders of Greek National Liberation Front sign truce ending civil war —Germans forced back twenty three miles in Belgium

Jan 13 Russians begin great offensive in Poland

Jan 14 Nazis withdraw to the Westwall

Jan 17 Warsaw, Polish capital falls to Soviet troops

Jan 20 Hungary signs armistice with the Allies

Jan 21 Russians take Tannenberg gain in Silesia

Jan 22 Ledo Road from Myitkyina Burma to Ledo India is officially opened

Jan 23 United States troops capture St Vith Belgium

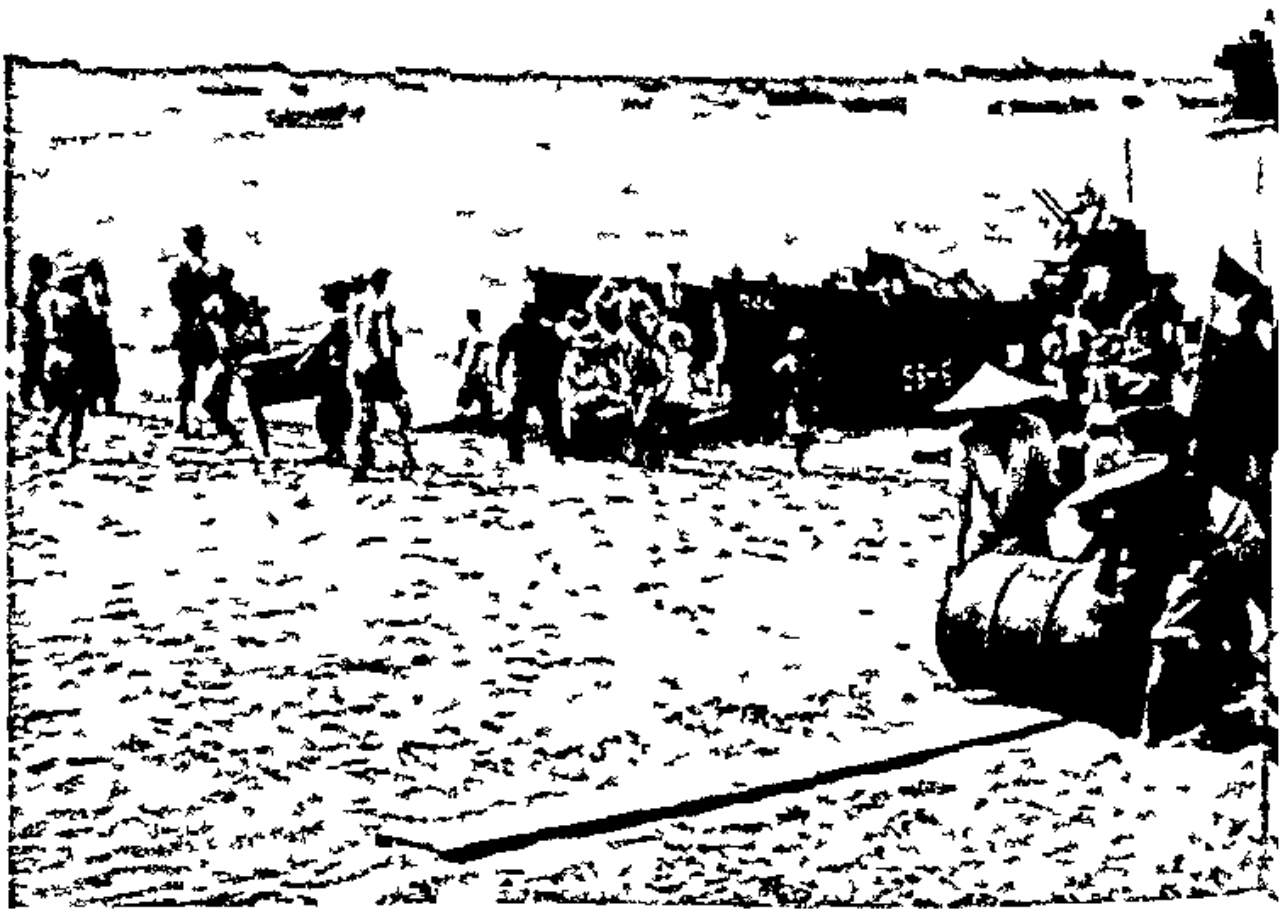
Jan 25 Russians seize Gleiwitz Germany 136 miles from Berlin

Jan 28 Americans retake Clark Field on Luzon

Jan 29 United States forces enter Germany near Oberhausen and Peterskirche —New landing made on western Luzon

Jan 31 Czechs recognize Polish Warsaw government

Feb 5 Ecuador declares war on Japan
Feb 6 General Douglas MacArthur announces fall of Manila
Feb 7 Paraguay declares war on Axis nations
Feb 8 Canadians and British start push in Holland
Feb 10 Americans take main Roer River dam
Feb 12 Official announcement declares that the Big Three Roosevelt Churchill and Stalin have met at Yalta in the Crimea Agreement has been reached on program to crush Germany and Forward World Government
Feb 13 Russian forces capture Budapest
Feb 15 Tokyo bombed by 1500 United States carrier planes
Feb 16 Americans land on Corregidor in Manila Bay
Feb 19 United States amphibious troops land on Iwo Jima 750 miles from Tokyo
Feb 21 Inter American Conference on Problems of War and Peace opens in Mexico City
Feb 23 Turkey declares war on Germany and Japan — Americans take Mt Suribachi on Iwo Jima.
Feb 24 Egypt declares war on Axis Egyptian premier is assassinated — Argentina only American nation not in United Nations Organization as Uruguay joins
Feb 28 Americans cross Erft River and approach Cologne — Saudi Arabia and Iran declare war on Axis — Egypt and Turkey in United Nations
Mar 3 Finland formally declares war on Germany
Mar 4 Russians reach Baltic coast near Kolberg Germany



Landing supplies on the west coast of Luzon Philippine Islands, following brilliant action in January

Mar 6 United States troops capture Cologne
Mar 7 Chinese clear enemy from Lashio, Burma
Mar 8 American forces cross Rhine via Hindenburg Bridge at Remagen fast action prevents Nazis from destroying structure—Inter American Conference on *Problems of War and Peace* closes at Mexico City Act of Chapultepec and Dumbarton Oaks Conference indorsed
Mar 10 Japanese seize control of Indo China
Mar 12 Russians take Kustrin Oder River stronghold
Mar 14 Royal Air Force announces bombing of Germany with new eleven ton bombs
Mar 16 It is revealed that giant German V 2 rocket bombs have been hitting London and southern England causing heavy damage
Mar 17 Japanese resistance ends on Iwo Jima
Mar 18 Americans invade Panay Island in Philippines without loss—Allied bombers blast Berlin in war's heaviest raid by daylight
Mar 20 British take Mandalay Burma
Mar 22 Delegates of six Arab states sign final draft of constitution for new Arab League
Mar 26 Americans enter Frankfurt and Limburg—Cebu Island in the Philippines is invaded
Mar 27 Argentina declares war on Germany and Japan
Mar 29 Negros Island invaded by United States forces
Mar 30 Russians take Danzig
Apr 1 United States Tenth Army lands on Okinawa Island in Ryukyu group
Apr 3 Siegen falls to American First Army
Apr 5 The Soviet denounces non aggression pact with Japan—General of the Army Douglas MacArthur and Fleet Admiral Chester W Nimitz to lead Army and Navy forces against Japan
Apr 7 Japanese lose six warships in sea battle fifty miles south of their home islands
Apr 9 Allies begin offensive in Italy—United States recognizes Argentina Government
Apr 11 Chile declares war on Axis—Spain breaks with Japan
Apr 12 President Franklin Delano Roosevelt dies succeeded by Vice President Harry S Truman
Apr 13 Vienna falls to the Russian army
Apr 16 Seventh American Army enters nazi shrine city of Nuremberg Hitler orders last stand
Apr 18 Germany split in two as American Third Army enters Czechoslovakia
Apr 19 United States troops take Leipzig and Halle
Apr 21 Soviet signs twenty year peace pact with Warsaw Polish government
Apr 22 Russians reach heart of Berlin
Apr 25 United Nations Conference on International Organization opens at San Francisco forty six countries represented
Apr 26 Bremen falls to British Stettin to Russians
Apr 27 Allies take Genoa in Italy
Apr 28 Benito Mussolini former dictator of Italy is executed by partisans in village of Dongo on Lake Como
Apr 29 British Eighth Army captures Mi



Official U. S. Navy photograph

Background: Ships of the Navy invasion armada.

lan and Venice in northern Italy
Apr 30 Munich falls to the Americans
May 1 German radio at Hamburg broadcasts report of Adolf Hitler s death
May 2 Nazis surrender Italy and part of Austria 1,000 000 men lay down arms
May 3 Hamburg gives up to the All es without a struggle —British take Rangoon Burma
May 4 Germans in Netherlands Denmark Helgoland northwestern Cermany and Frisian Islands surrender to Britsh
May 6 Germany signs m l tary surrender at Re ms France
May 8 V E Dav Germany officially surrenders unconditionally at 6 01 P M Eastern War Time
May 9 Reich Marshal Hermann Goering Field Marshal General Albert Kesselring and puppet Prem er Vidkun Quisl ng of Norway arrested as war crim nals
May 10 Australian forces capture Wewak Ienmsula in New Gu nea
May 15 Au tria abolishes all nazi laws and establishes prov s onal government —Former nazi I ropaganda Minister I aul Joseph Goebbels reported a su cide
May 17 Nagoya Japan hit with fire bombs by 500 B 29 Superfortresses for second t me in four days
May 21 Chinese take Hoch h in new Kwangsi Province drive
May 23 German General Staff dissolved Grand Admiral Karl Doenitz and aides seized —Heinrich Himmler former Gestapo chief commits suicide after capture
May 24 More than 500 B 29 s from the Marianas Islands bomb Tokyo
May 29 Yokohama pounded by 450 Superfortresses
June 4 All es announce terms of B g Four agreements setting up Allied Control Council to exercise supreme authority over post war Germany
June 6 Brazil declares war on Japan
June 7 King Haakon VII of Norway returns to Oslo after f v e years of ex le
June 11 Australians invade Borneo at four po nts in Brunei Bay area
June 15 Joach m von Ribbentrop former nazi Foreign Minister is captured in Swedish hideout
June 19 Lieutenant General Simon Bolivar Buckner commander of all land forces on Okinawa is k lled in battle
June 21 Organized Japanese resistance on

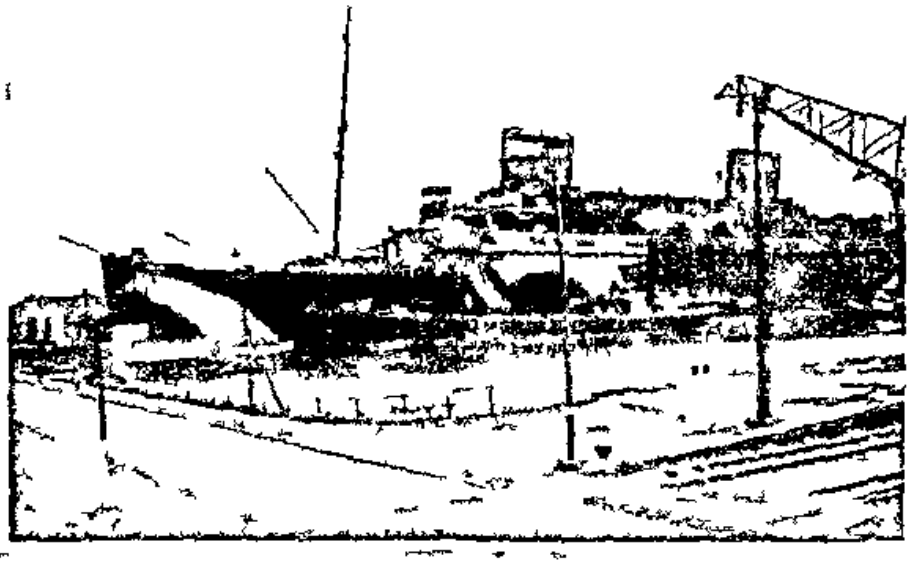


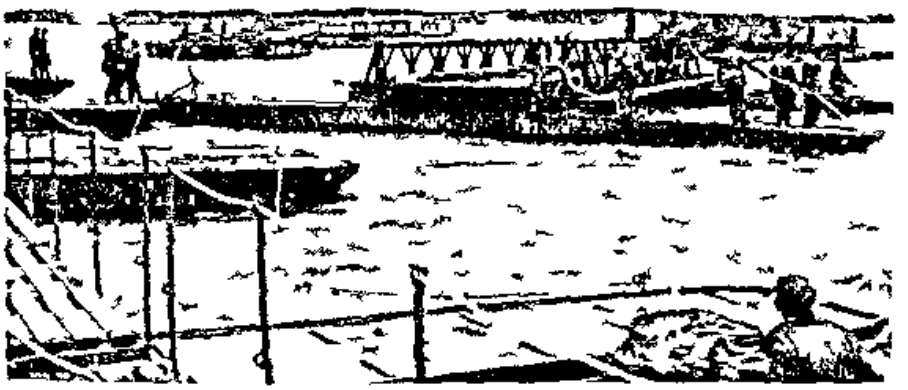
Sgt. J. Co. photo

A footbridge partly made of palm logs, used in the swift advance of U. S. troops near Lingayen, Luzon.

A ship the Germans did not dare to send to sea *during the hostilities*—the luxury liner Europa docked at Bremerhaven

Official U S Navy photo





Canad an A my photo

Canadian engineers at work floating sections of a *Bailey Bridge* into place on the Rhine

Okinawa comes to an end

June 26 United Nations Conference ends at San Francisco after sixty three days *with delegates from fifty countries* sign ing new world charter

June 27 General Mac Arthur proclaims full liberation of Luzon Island in I hilippines —Secretary of State Edward R Stettinius resigns

June 30 James F Byrnes is named Secre tary of State by President Truman

July 5 Conquest of the Philippines is com pleted

July 6 Nicaragua becomes first nation to *ratify United Nations Charter*

July 7 Polish Soviet trade pact signed in Moscow

July 10 Record land and carrier plane raids rip Japan

July 17 Churchill Stalin and Truman be g n Big Three Conference at Potsdam Germany

July 23 Marshal Henri Philippe I étain goes on trial for treason in Paris.

July 24 United States carrier planes attack *Japan s greatest naval base at Kure Hon* shu Island

July 26 Winston Churchill replaced as Prime Minister of Britain by Clement Att lee —President Truman announces joint United States Britain China uncondi tional surrender ultimatum to Japan This Potsdam Ultimatum outlines Allied policy for Japan

July 28 *United States Senate ratifies United* Nations Charter

July 31 *American destroyer force shells* Shimizu Japan s most important alumi num production center

Aug 2 Big Three parley adjourns at Pots dam fifteen page report on agreements reached is released

Aug 4 President Truman s gns Bretton Woods legislation United States first to

approve world bank and world fund

Aug 5 Atomic bomb smashes Hiroshima, Japan

Aug 8 Second atom charge loosed on Japa nese city of Nagasaki —Russ a declares war on Japan effective August 9 —Presi dent Truman signs United Nations Char ter

Aug 9 Russian offensive begins in Man churia

Aug 10 Japan makes b d for peace agrees to accept I otsdam Ultimatum if Emperor Hirohito is permitted to retain his throne

Aug 11 Allies agree to let Emperor retain throne if he will submit to authority of Supreme Allied Commander in Japan

Aug 14 Japan surrenders unconditionally fighting stops

Aug 15 Petain condemned to die for trea son sentence changed to life imprison ment by General Charles de Caulle

Aug 19 MacArthur aides meet Tokyo sur render mission in Man la

Aug 26 Russo Chinese pact signed on Aug 14 calls for mutual aid through Chung king Government Chinese Communists to get no aid

Aug 27 First American airborne troops land in Japan at Atsugi airdrome sixteen miles southwest of Tokyo

Aug 29 Four power War Crimes Commis sion releases names of twenty four nazi war criminals to be tried at Nuremberg

Aug 31 United States and Finland resume d plomatic relations

Sept 2 V J Day proclaimed as Japan signs official surrender terms aboard battleship Missouri in Tokyo Bay (Surrender took place on September 1 United States time)

Sept 4 American flag waves again over Wake Island as Japanese lay down arms

Sept 8 Tokyo officially occupied by United States troops —1 000 000 Japanese give up in China, Formosa, Indo China and the I escadores

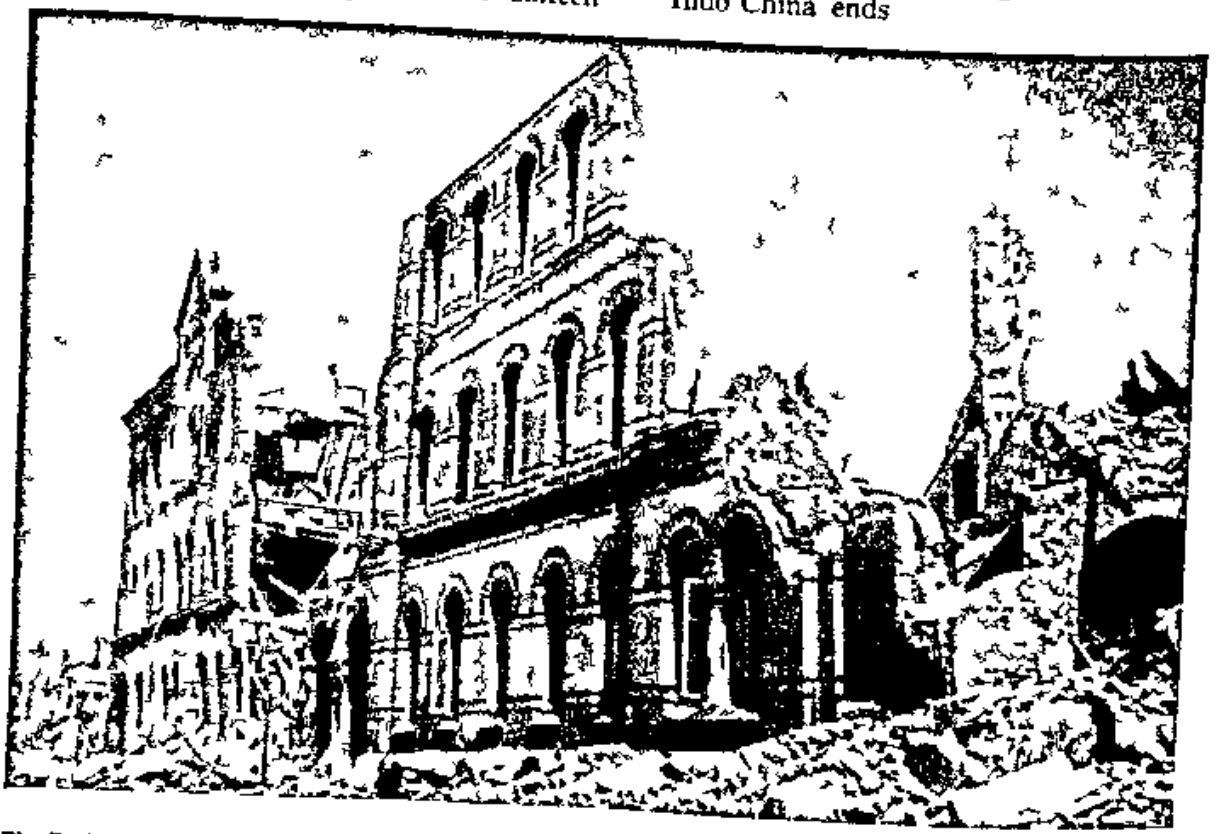
Sept 13 Imperial Japanese General Staff dissolved

Sept 19 Prime Minister Attlee of Great Britain pledges self rule for India

Sept 25 Natives of Annam revolt against return to French rule

Sept 29 Foreign ministers in London an nounce mutually satisfactory plan for es tablishing policy necessary to carry out Japanese surrender terms, United States to lead Far Eastern Advisory Commission

Oct 2 Annamese revolt against French in Indo China ends



The Post Office at Kiel, Germany after a Royal Air Force raid. Many raids were needed to put this Baltic port out of operation. Canad an Army Overseas photo



Official U. S. Marine Corps photo

At night the skies over Okinawa glowed with the flash of projectiles from the weapons of the Japanese and the Marines. In the battle for this island the United States suffered the heaviest losses of the Pacific war

Oct 3 Russia refuses to join Far Eastern Advisory Group unless four power control council for Japan is established

Oct 4 Indonesian nationalists in Java seize cities of Surabaya and Bandung in protest against Dutch rule

Oct 6 New Japanese cabinet organized with Baron Kijuro Shidehara as Premier

Oct 8 President Truman says the United States will keep the atomic bomb secret

Oct 10 United States invites representatives of nine governments to Washington on October 23 for Far Eastern Advisory Commission discussion—British and Russian troops to leave Iran—France and Britain sign pact recognizing French rights in Indo China

Oct 15 Former French Premier Pierre Laval is executed in Paris as a traitor after suicide fails

Oct 16 United Nations Food and Agriculture Organization holds first session at Quebec Canada

Oct 19 Far Eastern Advisory Commission meeting postponed in Washington as Russia fails to accept invitation

Oct 20 Outer Mongolia votes to cut all ties with China and become independent republic

Oct 21 French vote approval of General Charles de Gaulle's plan to draft a new constitution

Oct 23 Vidkun Quisling is shot as a traitor in Norway

Oct 24 The United Nations Organization is a reality as the Union of Soviet Socialist Republics becomes the twenty ninth country to ratify the charter

Oct 28 Chinese Communists report clashes between their troops and Chungking Nationalist armies in eleven provinces

Oct 29 Getulio Vargas resigns as president of Brazil replaced by Supreme Court Justice Jose Linhares until coming general elections

Oct 30 First meeting of Far Eastern Advisory Commission in Washington votes recess for week Russia still absent

Nov 1 United Nations Food and Agriculture Conference ends in Quebec with an appeal for constructive world action

Nov 2 United States recognizes the provisional governments of Hungary and Brazil

Nov 5 President Truman opens a labor management conference in Washington with eighteen delegates from each side in attendance—Hungary has first popular election in its history Small Landowners party wins over the Socialists and Communists

RESCUE IN THE WAKE OF VICTORY



Offic al U. S. Navy photograph

Wild with joy! These cheering shouting prisoners are grinning from ear to ear with happiness They are just a few of the many who in 1945 saw the finest sight of their lives—approaching rescue! These Allied prisoners of war are at Aomori near Yokohama on the Bay of Tokyo How proudly they bear the symbo s of victory flags of the United States Great Britain and Holland They a e giving a mighty welcome to U S Navy rescuers who on August 29—before the Japanese surrender was signed—entered Tokyo Bay wi h needed suppl es.



Signal Corps photo

The most famous prisoner of war—General Jonathan M Wainwright haggard but smiling after being rescued from three long years of Japanese imprisonment.

Nov 6 Indonesia rejects the Netherlands *offer of empire status full independence is revealed as chief objective*

Nov 7 Arabs kill seventy four Jews in Libya troops restore order —British jet propelled airplance flies record 606 miles per hour

Nov 8 British warn Indoesians to disarm or face attack —*Tripolitania riots rage anew*

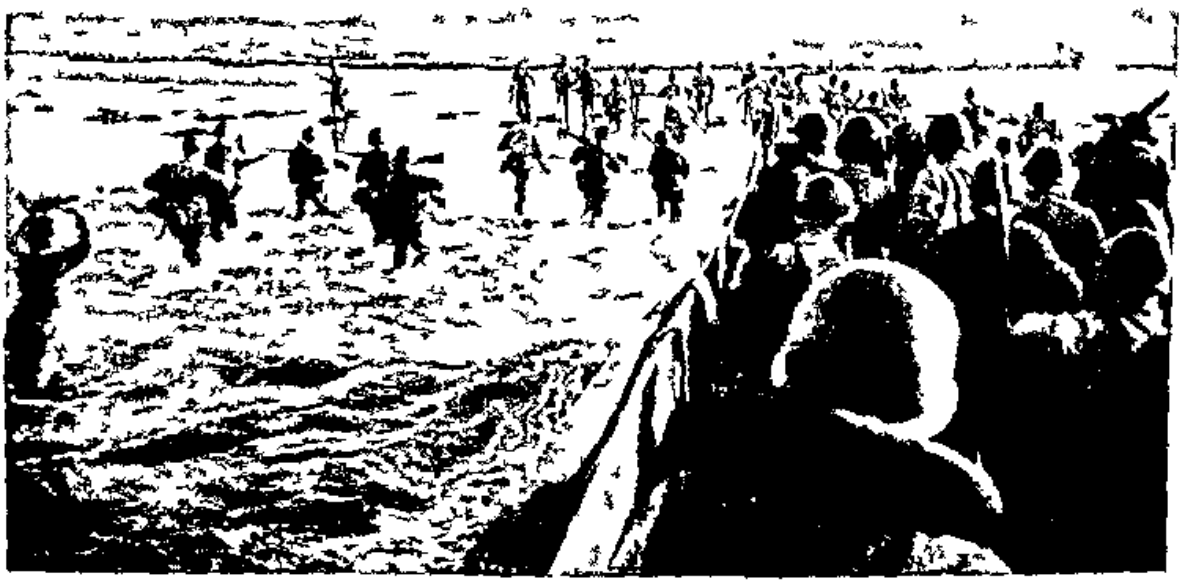
Nov 9 United States and sixteen other countries meet in Paris to discuss German reparations

Nov 10 Prime Ministers Attlee of Great Britain and King of Canada arrive at Washington for atomic bomb control discussion

Nov 11 Planes blast Java naval base of Surabaya as British advance against Indonesian nationalists

Nov 12 Former United States Secretary of *State Cordell Hull awarded Nobel Peace Prize for 1945 International Red Cross for 1944*

Nov 13 President Truman agrees to joint inquiry with British on Palestine issues — Tally of Yugoslavian ballot held on November 12 finds sweeping victory for



Official Marine Corps photo

Leathernecks wading towards the shore line of the Land of the Rising Sun to assist in the occupation of Japan.



Senate Foreign Relations Committee opening the hearing on the United Nations Organization Charter July 9

Press Assoc at on Inc.

Marshal Tito s regime —General Charles de Gaulle unanimously elected interim president of Provisional French Govern ment

Nov 14 Russia again asks for veto vote in Japanese Control Council

Nov 15 President Truman and Prime Ministers Attlee and King announce in Washington that atomic bomb secret will not be shared until the United Nations Organization devises a control plan

Nov 18 Bulgaria holds first general election since 1940, Fatherland Front party wins —Revolt reported in Azerbaijan province of northwestern Iran

Nov 19 Chinese Nationalists drive forty miles into Manchuria —Iranian troops move to halt rebels in Russian occupied province of Azerbaijan

Nov. 20 Nazi war crimes trial starts at Nuremberg Germany —General of the Army Dwight D Eisenhower appointed Army Chief of Staff Fleet Admiral Ches ter W Nimitz made Chief of Naval Op erations —A B 29 Superfortress smashes seven year record by flying 8,198 miles non stop, Guam to Washington D C

Nov 21 The United Automobile Workers of America strike against the General Motors Corporation.—General Alexander Patch, leader of the United States Seventh Army in Europe dies at San Antonio, Texas

Nov 22 Chinese Nationalist troops out flank south Manchurian port of Hulu tao

Nov 24 General MacArthur imposes severe tax on all Japanese wealth

Nov 25 First Austrian general election in fifteen years indicates defeat for the Com munists in an overwhelming Socialis victory

Nov 26 United States proposes that the Big Three remove all troops from Iran by January 1, instead of March 2, action urged to calm fears of small nations

Nov 27 Major General Patrick J Hurley resigns as United States Ambassador to China, denounces State Department pol icy, replaced temporarily by General of the Army George C Marshall

Nov 29 Surabaya falls to the British after nineteen-day battle—Monarchy ends in Yugoslavia

Nov 30 Labor Management Conference closes in Washington after little success

Dec 2 Brazilians cast first presidential vote in fifteen years General Eurico Gaspar Dutra is elected—Albania votes in nation's first free ballot Democratic Front wins by large majority

Dec 3 Russia rejects United States proposal to leave Iran by January 1

Dec 4 Alcide de Gasperi named Premier of Italy by Prince Humbert Lieutenant General of the Realm

Dec 6 Lieutenant General Tomoyuki Yamashita convicted as war criminal in Manila will die by hanging—United States and



Press Associat on Inc

General George C. Marshall (left) new U S. envoy to China visiting Chiang Kai shek and Madame Chiang

Great Britain announce signing of a new loan agreement whereby the United States will lend $4,400,000,000 to England

Dec 9 General George S Patton Jr seriously injured in automobile accident at Mannheim Germany —General MacArthur orders Japanese Government to submit plan ending feudal farm system

Dec 10 RAF planes destroy Indonesian village after ambush of British convoy

Dec 12 Chinese Central Government troops enter Manchurian capital of Mukden no Communist opposition

Dec 13 Britain and France conclude agreement on Syria and Lebanon all troops to be withdrawn December 21

Dec 15 United States chosen as permanent home for the United Nations Organization

Dec 16 Big Three foreign ministers open meetings at Moscow —Chinese Communists in Chungking to discuss peace

Dec 17 United States Supreme Court stays execution of General Yamashita

Dec 19 President Truman nominates former Secretary of State Edward R Stettinius Jr as principal United States delegate to the United Nations Organization Other delegates nominated are Secretary of State James F Byrnes, Senator Tom Connally Senator Arthur H Vandenberg and Mrs Eleanor Roosevelt

Dec 20 Dr Karl Renner, Socialist, is elected president of Austria

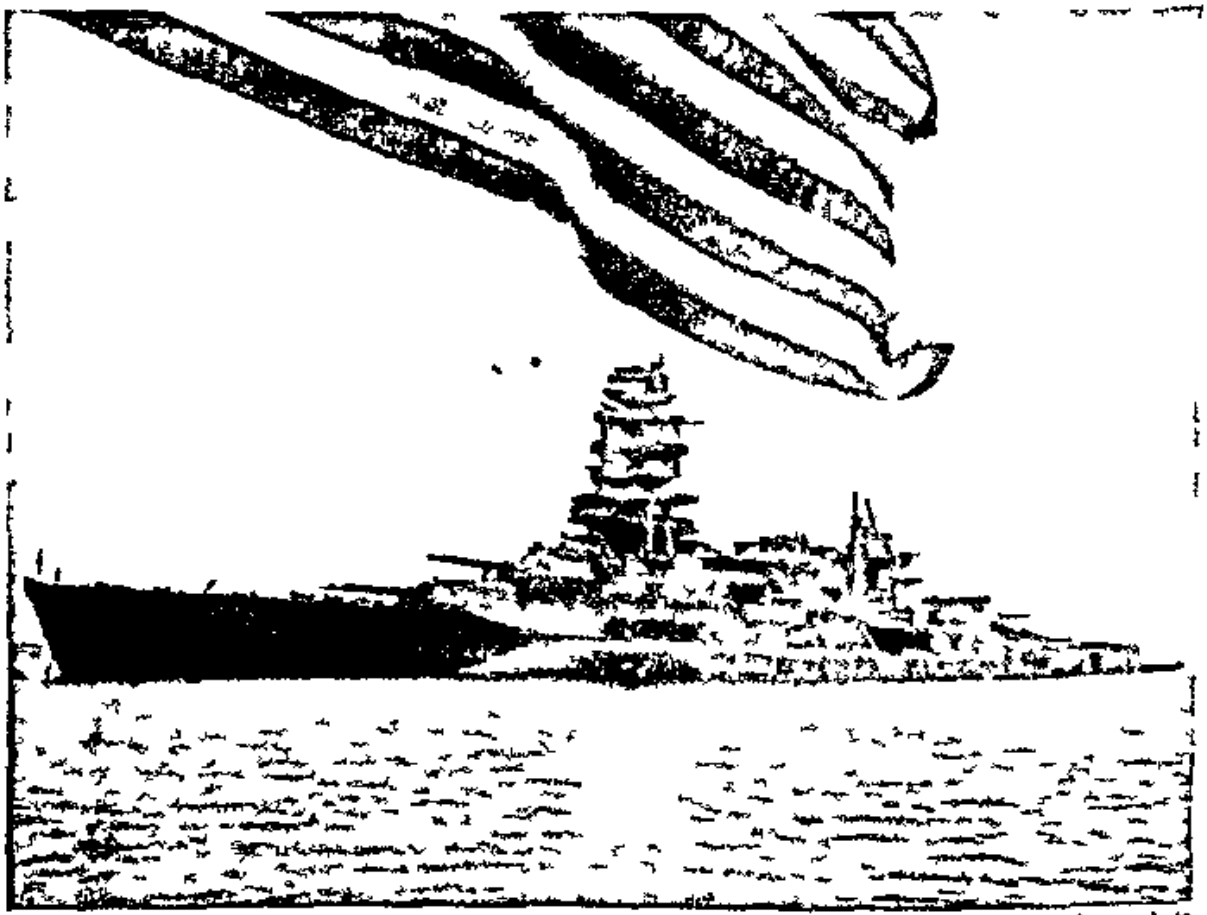
Dec 21 General George S Patton, Jr., dies at Heidelberg Germany

Dec 22 United States and Great Britain recognize the Yugoslavian Republic

Dec 23 Pope Pius XII announces names of thirty two new cardinals, for the first time in history every continent will be represented in the College of Cardinals

Dec 25 French Government announces devaluation of the franc.

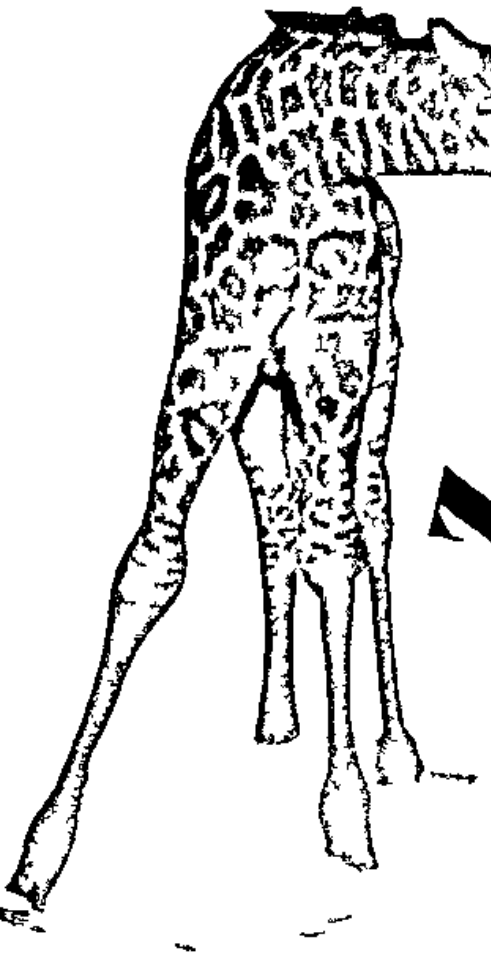
Dec 27 Big Three state conclusions reached at Moscow conference of foreign ministers international control of atomic energy agreed upon Russia gets veto vote in Japanese affairs —Twenty-eight nations sign Bretton Woods Monetary Pact at Washington Russia absent



Official U S. Navy photo

The last battleship left in the Japanese Navy—the Nagato—was found in Tokyo Bay as United States forces approached to occupy Japan. The Stars and Stripes fly symbolically from a U S warship passing the Nagato.

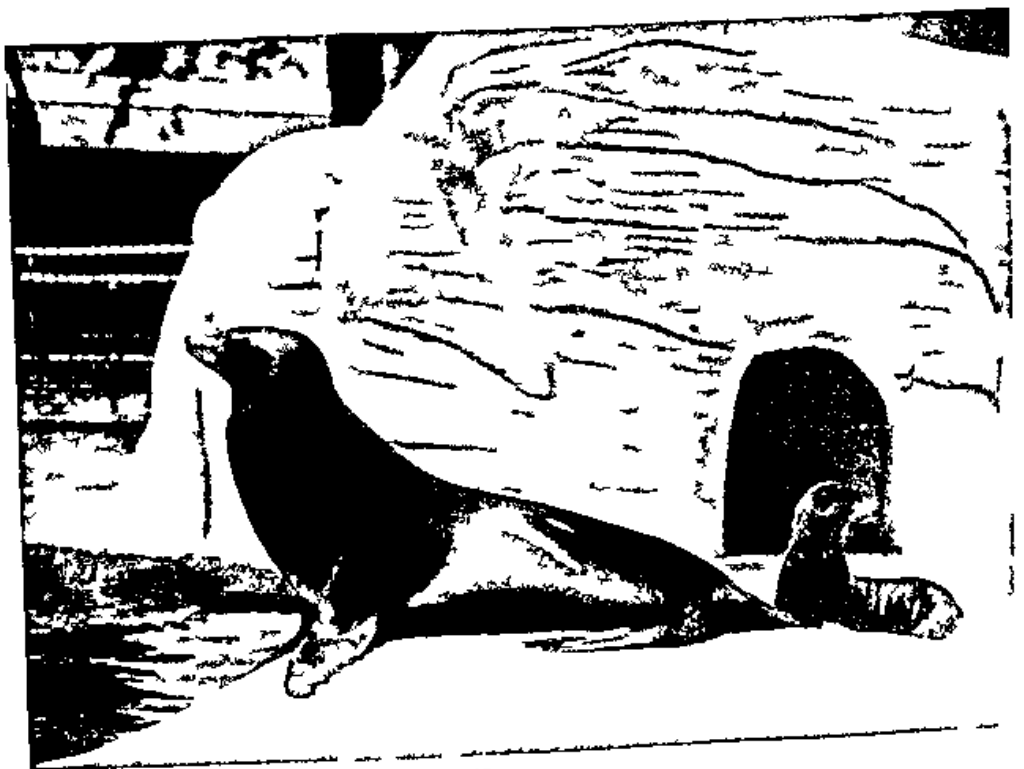
Zoo Babies



This baby giraffe
Would make you laugh
  His legs are long and lurchy
And who would want a name like his?
Scientifically he is
  Giraffa tippelskirchi

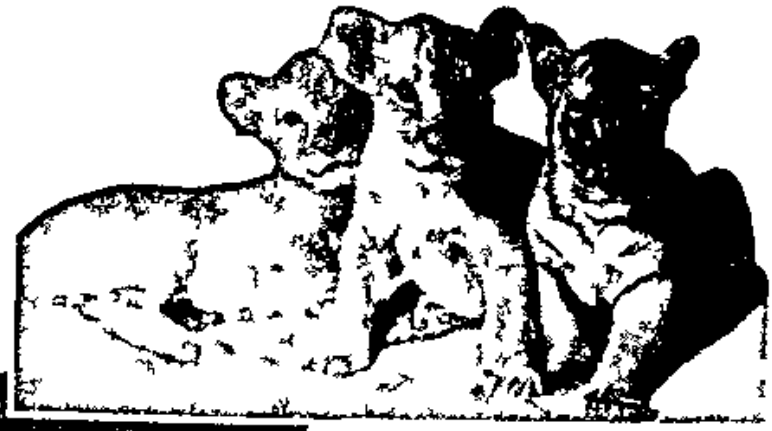
Mama sea lion full of zip
Is taking baby for a dip
The house they live in is so nice
It's easy to pretend it's ice!

St. Louis Zoological Gardens



New York Zoological Society

Three l ttle kittens No not these
Two l ons and a t ger please



N w Yo k Zoo g l Soc y

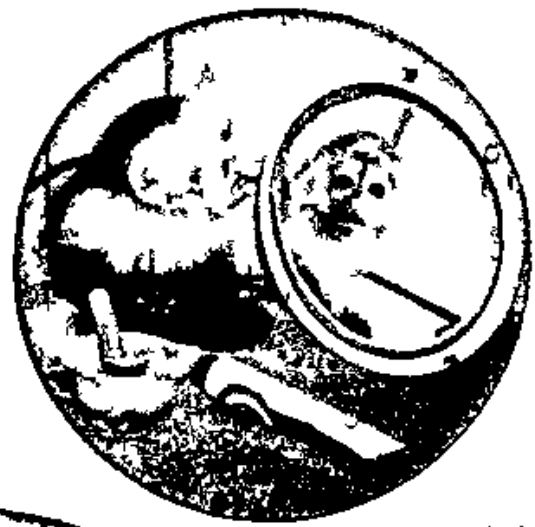


N w Yo k Zoo g al So e y

What s th s? What s th s
A babv llama
W h sper ng secrets
To ts mama

Th s t ny baby monkey
Longs to
F nd out whom that face
Belongs to

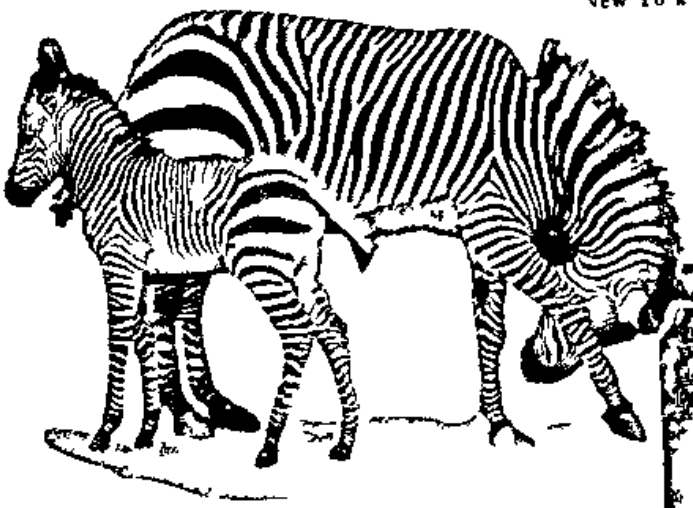
Baby kangaroos don t fuss
About a trolley or a bus
But r de where er mama goes—
Rather bumpy I suppose



Cr a Pa k
Zoo, N w Y k
C ty

S Lou s Zoo g cal Gard n

New Yo k Zoo g a Soc y



Zebras dressed n black and white
Can h de bv day as ell as n ght
In forests w th the r trees and such
W here you can t see them very
n uch



This cunn ng l ttle
Aoudad
Makes its mother
Proud and glad

S Lou s Zoolog ca Ga d ns

(lowe left)

New Yo k Zoo og al Soc ety

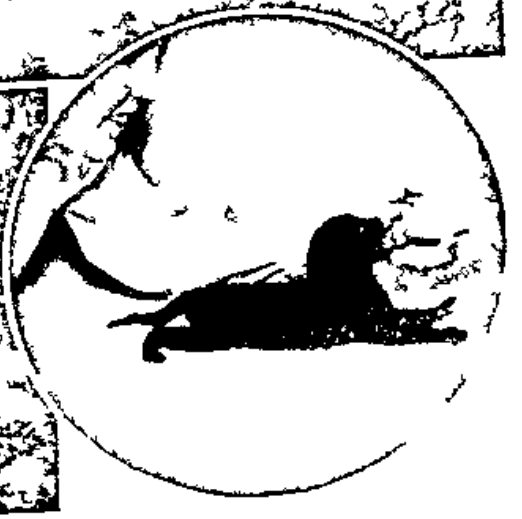
Cynth a the baby
Is always cutting
capers
Mama is much calmer
And both of them are
tap rs

(lo wer right)

A t ny black leopard
Is fun to take care of
But in a few months
He ll be one to beware of

New Yo k Zoolog cal Soc ety







Cubs in a zoo
Have lots to do—
'Specially three
As bright as we'

Brookfield Zoo photos courtesy of The Chicago Sun



Three little bears
Let's watch them play
Wynken Blynken
And Nod are they
Blynken's collars
A handsome sight
Wynken's chevrons
Are snow white
Nod's their sister
She is small
But she's the liveliest
Of all!



A little bear
Just like a bunny,
Plays when it is
Warm and sunny





Piggety pig!
I don't care a fig
If brother eats
Just like a pig!


THINGS TO MAKE
and
THINGS TO DO



This unde we sc ne s a fing pa nti g by Ru h Fa son Shaw the nvento of the a t of finge pa nting The autho of his arti e was presen when M ss Shaw pa nted he scene I ok he about a quar e e an h u

FINGER-PAINTING



Courtesy Binney and Smith Company

Two youthful finger painting experts Finger painting appeals to young people and to their elders too

NOT so very long ago in a school for American and British children in Rome Italy a little boy cut his finger His teacher an American lady called Miss Ruth Faison Shaw told him to go to the bathroom and put some iodine on the cut The little boy did as he was told Then he happened to run his iodine stained finger along the bathroom door In so doing he produced what seemed to him to be a very pretty kind of pattern

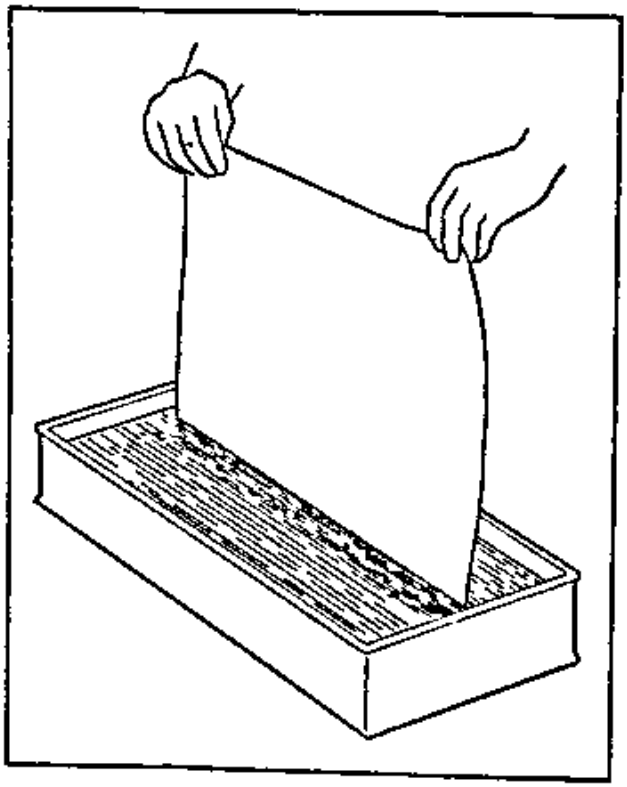
Now many generations of children have loved to make pictures and designs with their fingers—in sand and mud on the dust that settles on furniture on frosted window panes It was perfectly natural therefore for the little boy to continue with his iodine decoration of the bathroom door He found his task so pleasant that the time passed very quickly Finally his teacher decided to see what was keeping him so long When she entered the bathroom she saw the boy's masterpiece on the door

Since Miss Shaw was a wise teacher she did not become angry She realized that the boy was doing a perfectly natural thing he was simply expressing himself artistically In fact she suddenly realized that finger painting offered many exciting possibilities Would it not be an ideal artistic activity for young children who lack skill in handling brush and pencil?

So Miss Shaw decided to perfect a paint that would be suitable for this purpose It would have to be non poisonous, because children might absent mindedly put their paint stained fingers in their mouths After much experimenting Miss Shaw finally created a paint which looked like jelly and felt like soft mud With this material children could paint away to their heart's content with perfect safety to themselves and to their clothing as well

It was in the year 1931 that Miss Shaw perfected her finger paints In the following year she brought them to the United States The art of finger painting has been popular from that time to this It is now a favorite activity in schools in summer camps in playgrounds and in homes Although it was first created for young children it has attracted older children and adults including professional artists In World War II finger painting was used to provide entertainment in USO (United Service Organizations) clubs and in hospitals maintained by the armed forces

In this article we shall tell you how you too may take part in this fascinating activity First of all of course you must provide yourself with the paints Shaw finger paints in glass screw top jars may be bought in a special set of six the set includes paper and spatulas (A spatula is a spoon like implement used in dipping out paint) Sets containing six ¼ pint jars of paint and twelve sheets of paper cost $2 20 those with six ½ pint jars and twenty four sheets of paper cost $3 60 The paint jars and paper may also be bought singly There are six colors



How the wet paper should be removed from the pan.

in all—yellow red blue green brown and black

As we have pointed out the paints are harmless when swallowed though of course they are not meant for swallowing! They are harmless to the skin They can be washed off the hands or arms with water If the paint gets on woolen clothing it may be brushed off when it dries If it gets on cotton material it will come out if the material is soaked in cold water and then dipped in warm soap suds

In addition to the paints you will need a wooden spatula for each jar The paper on which you are to paint comes in sheets 16 inches by 22 inches This paper has a special glaze on one side the other side is plain The painting is to be done on a table with a smooth washable top Tables with porcelain enamel linoleum or marble surfaces are best for this purpose A table top covered with oilcloth is also acceptable

Since you will have to wet the paper before working with it you should provide yourself with a pan more than 16 inches long An ordinary sink will do just as well if you can set up your working table near it You should also have a small bowl or pan in which to wet your hands while painting and a bucket of water for washing your hands and arms and for cleaning the spatulas when your painting is finished You should lay in a supply of newspaper or sheets of rough cardboard larger than the paper on which you paint (As we shall see the newspaper or cardboard is to be used for drying purposes) Finally you should have paint rags any clean rags will serve the purpose

We are now ready to paint First we make sure that the surface of the table on which we are to work is perfectly clean Then we bare our arms to the elbows and as far above the elbows as possible Next we take a sheet of paper and roll it into the form of a cylinder working from one of the short sides of the paper We put the cylinder into a pan of water or into a sink Then we take hold of two corners of the paper and draw it out of the water as shown on this page

We put the paper glazed surface up on the table With one hand we smooth out wrinkles and air bubbles with the other we lift the edge or the corners of the paper to let the air escape We now select one of the colors in the paint jars before us With a spatula we dip out a quantity equal to a tablespoonful and put this upon the paper Wetting our hands we smear the color over



Courtesy Binney and Smith Company

This young artist is using all the fingers of his right hand to produce the effect that he wants. Very thin lines are made with the fingernails.



The Fisherman This painting was done by the little boy whose iodine experiment is described in the article

the sheet of paper and with the flat of the hand we work away at the blob of paint until it has been spread evenly and smoothly over every square inch of the surface of the paper

In painting you are to use your palms, the side of your hands your finger tips your fingernails, your knuckles your thumbs even your forearms Work with rhythmical muscular movements of the whole body do not be afraid to let yourself go Never mind about producing a masterpiece at first Just work away with all the natural brushes that we named above and see what effects you can produce Experiment and make discoveries If the paint becomes dry, a few drops of water should be sprinkled on it Wet paint gives better contrasts and more pleasing textures than dry paint

Here are some useful hints The background and far away things should be done first they should be started at the top rather than at the bottom of the paper For a smooth background cover the paper with even vertical or horizontal strokes applied with the flat of the hand the forearm may also be used for this purpose

Use your thumb for stems and flowers pat the paint with the side of the hand for foliage use the fingernails for fine lines or grass To make a part of your painting lighter, apply pressure as you move your palm over the paper You can stroke out details with your fingernails At any time you can rub out what you have done by moving the flat of the hand over the paper

You may paint with one color or with more than one It is advisable however to work in one color until you become familiar with the technique of finger painting Colors may be blended by putting one on top of the other and then rubbing away until you have the desired hue You may apply pure color to a given part of the painting by wiping out the background with the fingers or with a paint rag New color may be rubbed smooth on the table top or in the palm of the hand

You will be amazed at the number of subjects that lend themselves to finger painting You will be able to create all sorts of imaginative and decorative patterns You will be able to produce trees and flowers mountains and country lanes animals and birds the waves of the ocean the fascinating regions that lie beneath the surface of the water Some people have even done excellent portraits with finger paints

When you have produced a painting with which you are satisfied the next step is to

dry it Lift the paper up by two corners and place it, painted side up, upon a newspaper or a piece of rough cardboard larger than the painting itself It will take about two hours for the painting to dry When it is entirely dry, run a hot iron over the back of the paper This is done in order to smooth out wrinkles and to prevent the edges of the paper from curling The paint will not rub off or peel unless it was not worked in smoothly in the first place

The dried painting will be in a permanent form—that is, unless you apply water to the painted surface You can easily make the painting waterproof by giving it a coat of clear shellac If you wish to keep a collection of your paintings, write your name and the date in lead pencil on the plain side of the paper before you begin to work with it In this way you will be able to trace the progress that you have made

When you have finished painting, wash the table top so that there is no trace of paint on it, use a paint rag to rub off the paint Also wash the spatulas that you have used and replace the screw tops on the jars of paint Finally wash your hands and arms (and face, if necessary)

Finger paints may be used to decorate a number of different objects You can put beautiful designs on wooden articles—trays, telephone screens, book ends and unpainted furniture The best effects are produced on soft light-colored wood Be sure to work the paint in smoothly Paint soaks into the wood as it is worked Therefore, in order to get pure color, it should not be worked over too often By applying shellac, you can make any finger painted wooden surface washable

In making desk sets, blotter covers, portfolios and scrapbook covers, cardboard can be used as a base on which to paste finger painted paper, or else the painting can be done directly on the cardboard The edges are more attractive when bound with black or colored passe partout. (Passe partout is a



White Herons by Kathleen Caffee This beautiful study shows the remarkable effects that can be produced in the medium of finger painting by mature artists. The artist's fingernails were used freely in this composition

s rong gummed paper, used especially for mounting pictures)

Finger painted wastepaper baskets are very attractive Make the pattern and trace the outline on cardboard Paint directly on the cardboard When the paint is dry cut out the basket Passe partout can be applied along the edges if desired Join by lacing through punched holes or by means of brass fasteners

It is interesting to note that while finger painting for beginners is something quite new the use of one s fingers and hands in applying ordinary paints goes back several hundred years This type of painting was developed in China by a famous artist called Kao Chi pei who died in the year 1739 Ac cord ng to the story Kao used to paint with brushes l ke all the other artists of his day He became so successful that he could not find time to finish all the paintings that rich patrons ordered

One day one of he e patron ame into Kao s studio and told h n that h n ust finish at once a painting tha h at had or dered Kao repl ed j k kl th n that if he insisted on having a l o led n such a very short time the t w u l ha e to work with h s f ngers \ l K g t ut his paints and began to ap ply th e l h s fingers To his surprise he p odu l real masterp ece wh ch the a t s pa and the general publ c too grea l ad d l

Many of Kao s patrons to having the artist do finger pa nt ng f r th too It is said that in the course of t n e Ka abandoned his brushes altogether and used only his f ngers in his pa nting A number of Chinese artists have tried their hand at fin ger painting since Kao s day This Chinese art is called finger tip pa nting The paint used is like an ink unlike the Shaw finger paints it can not be rubbed out and painted over and over until the result is satisfactory

CHARADES

A CHARADE is a puzzle the solution of which is a word of two or more sylla bles Each syllable is given to the solver by means of a description or by acting out a scene By putting the syllables together you will have the desired word For example suppose you have the following descriptions "My first (that is the first syllable) is a beast of burden my second is a place where a river may be crossed with ease my whole (that is the whole word) is a place of learn ing Here is the solution the beast of bur den is an ox the place where a river may be eas ly crossed is a ford the place of learn ing is Oxford

Can you solve the following charades? They are really qu te easy If you can not guess the first syllable try the second it may give you the necessary clue to the word The answers are given upside down on page 374

1 My first is a place where travelers stay
If you have my second you re very wise
You ll find my whole where people pray
Its fragrance rises to the skies

2 My first is never short
My second has many a port
My third is neither a woman nor a child
My whole you ll find when goods on docks are piled

3 My first s a favorite fish that s found right off the coast
If you do my second you have no cause to boast
My whole is pleasing in the noonday sun
But sometimes when it s cast our joy is done

4 You use my first to make the things you eat
You sometimes climb my second to fill my first
My whole arranged in rows in order neat
Contents the appetite and quenches thirst

5 On my first you ll take a ride
With my second by your side
When you come home unfeeling soul
I fear you ll trample on my whole

6 My first s a tiny creature busy as can be
My second a famous boat in days of old
My third on many a cot or bed you'll see
My whole s a place where you can t shun the cold

7 My first belongs to womankind
My second guards you well from cold
My whole I m very sure you ll find
Always alone and often old

8 My first is oft a stone
My second s one letter alone
My third is you and I
My whole will make you cry

HOW TO TELL A PERSON'S AGE

WE are going to begin by giving you what seems to be an ord nary table of figures As you see there are six columns of figures in the table the numbers range from 1 to 63 and they follow in order in all three of the columns

1	2	4	8	16	32
3	3	5	9	17	33
5	6	6	10	18	34
7	7	7	11	19	35
9	10	12	12	20	36
11	11	13	13	21	37
13	14	14	14	22	38
15	15	15	15	23	39
17	18	20	24	24	40
19	19	21	25	25	41
21	22	22	26	26	42
23	23	23	27	27	43
25	26	28	28	28	44
27	27	29	29	29	45
29	30	30	30	30	46
31	31	31	31	31	47
33	34	36	40	48	48
35	35	37	41	49	49
37	38	38	42	50	50
39	39	39	43	51	51
41	42	44	44	52	52
43	43	45	45	53	53
45	46	46	46	54	54
47	47	47	47	55	55
49	50	52	56	56	56
51	51	53	57	57	57
53	54	54	58	58	58
55	55	55	59	59	59
57	58	60	60	60	60
59	59	61	61	61	61
61	62	62	62	62	62
63	63	63	63	63	63

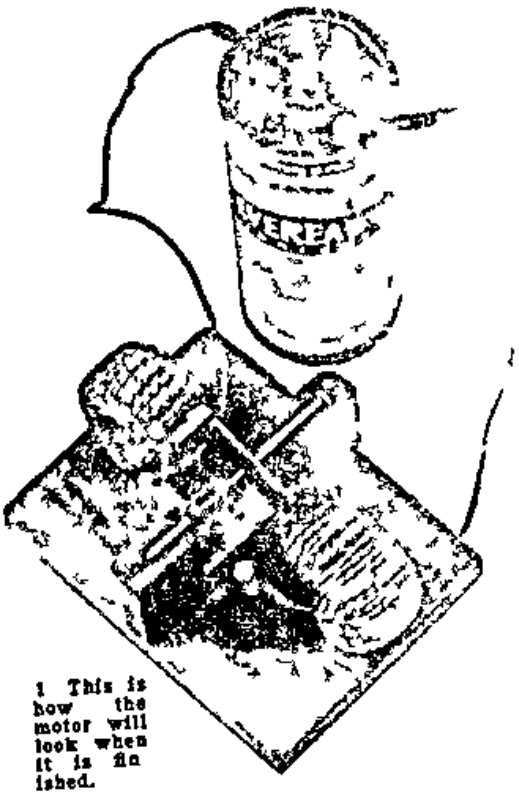
Yet this is no ordinary table for with it you will be able to tell the age of any person from one to sixty three years old—quite a range of ages with which to work

This is how you use the table Suppose that you want to find out the age of a friend Show h m the table of figures and ask him in which column or columns his age is given Then add up the figures at the top of these columns and you will have the answer Let us take a definite example Mr Jones who is 25 years old will tell you that his age is listed in the first fourth and fifth columns The figures at the head of these columns are 1 8 and 16 Added together they give 25 that is Mr Jones s correct age

ANSWERS TO CHARADES

Here are the answers to the charades (1) Incense (un sense) (2) Longshoreman (long shore-man) (3) Shadow (shad-owe) (4) Pantry (pan tree) (5) Carpet (car pet) (6) Antarctic (ant ark tick) (7) Hermit (her mit) (8) Piteous (pit e us)

HOW TO MAKE AN ELECTRIC MOTOR



1 This is how the motor will look when it is finished.

WE are going to show you how to make an electric motor that is designed to operate from a single dry-cell battery It is made from inexpensive materials and is quite easy to build If you follow instructions carefully, you will have a motor that will really run At the same time you will have learned just what makes your motor run

MATERIALS REQUIRED Figure 2 shows the materials that you will need They include

1 wood block 2⅜" x 4½"
1 wood block 4½" x 6"
(Both blocks should be cut from soft pine wood preferably ¾" thick. Grain of wood should run with the longest dimension of each piece)
1 11½" length of ⅛" thick x ¾" wide soft iron (strip steel)
1 1¾" length of same iron as above
1 16 penny common spike nail (iron)
2 4 penny common nails (iron)
2 No 8 1¼" long round head wood screws (iron)
1 6 length of ¾" wide friction tape
1 6 length of common wrapping string
1 ½ lb Coil No 18 Bell Wire (annunciator wire) 75 all in one length
1 1½ volt dry-cell battery (No 6 preferred)

BASE The large wooden block is used for the base of the motor and requires no further work

BEARING BLOCK The bearing block should be made from the small wood block as shown in Figure 3 The notch in the bottom ¾ wide by ⅛" deep should be just large enough so that the iron can pass through

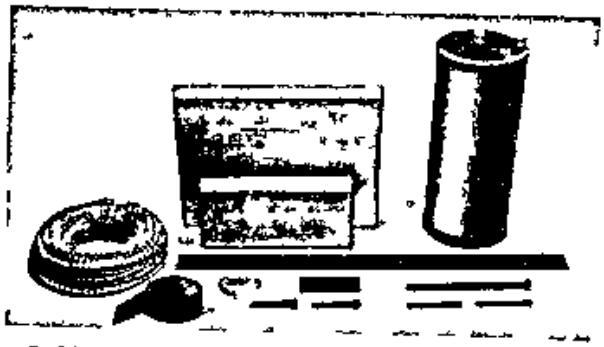
FIELD POLES The long piece of iron is to be bent to the shape shown in Figure 4 First find the center of the iron and mark a line with a pencil 1½ each side of the center The part of the iron between these lines will form the flat 3 section at the bottom Then bend the iron between the two pencil marks and the ends of the iron keeping the dimensions as close as you can to those in the diagram

You can bend the iron with a hammer on a block of wood or else you can put the iron in a vise, and use a monkey wrench forming the iron around a rod or pipe The bent iron need not follow the pattern exactly However the space between the poles (the ends of the iron) must be two inches and each pole must be two inches from the bottom

ARMATURE IRON See Figure 5

ARMATURE SHAFT The spike to be used for the armature shaft should be perfectly straight Remove the tool marks from the head with a file or with emery cloth Also remove any irregularities or enlargements near the point of the spike

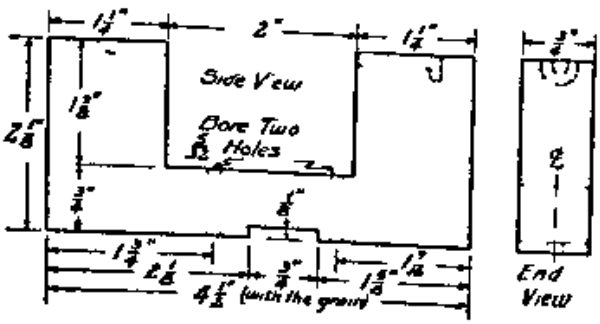
ASSEMBLY The field pole iron (the long bent iron) is to be set in place in the notch



2. Materials required to make the electric motor

on the underside of the bearing block Then the bearing block is to be attached to the base by means of the two No 8 wood screws (See Figure 1) Two 4 penny nails are now to be driven in the base, ½" from both the iron and the bearing block as shown in Figure 6 Note that these nails are on the side of the field pole iron that is nearer the point of the spike

Next we make the armature bearings These are hollowed out places in which the spike containing the armature iron will turn First lay a spike across the bearing block so that it will be in the exact center then mark the location for the head and the point of the spike (Note The field pole iron is closer to one bearing than the other The



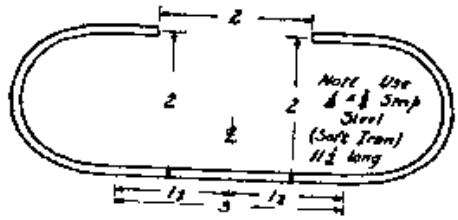
3. How to prepare the bearing block

head of the spike must be on this closer bearing) Heat the spike and burn in the head into the block Do the same with the point end, repeating the process until the spike has burned a bearing as deep as the diameter of the spike Rotate the spike while burning After burning, add a few drops of light oil Figure 9 shows how the bearings will look when your task is completed

WINDING THE FIELD COILS. With the field pole iron in place, wrap the places where the coils are to be located with friction tape (See Figure 6) An 18" length of tape is required for each pole At each turn the new layer of tape must cover one-half of the last layer

We are now ready to wrap the wire (No 18 Bell Wire) around the taped part of the iron Allow 12" of wire for the battery lead —that is, the section of wire that is to lead from the field pole iron to the battery After you have measured out the 12" of wire, start at the base on either pole, wrapping the wire in a clockwise direction (See Figure 7) Lay each turn as close as possible to the preceding one, continuing to within ½" of the top This should take about 40 turns

Before the last three turns are applied at the top put a 1" length of tape under the wire, folding the tape back over the windings



4 Field poles

5. Armature iron.

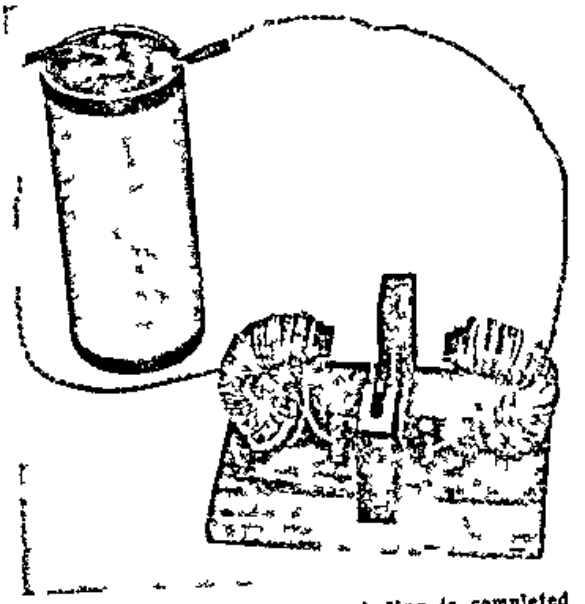
when the return layer is started Add the second layer, laying the turn as closely as possible until you reach the base again This should take about 36 turns Lay on the third layer up, and the fourth layer down Each will take about 30 turns, making a total of about 136 turns It is not necessary to have exactly 136 turns, a few more or less will do no harm

After completing the winding process, leave 12" of wire—the finish wire, as it is called—and cut off the rest The finish wire should be wrapped around the 4 penny nail which has been driven into the base, ½" from both the iron and the bearing block This nail serves as a brush holder, and the end of the wire, with the insulation removed, forms the brush The brush should point upward, as shown in Figure 8



6 How tape is wound around the field pole iron.

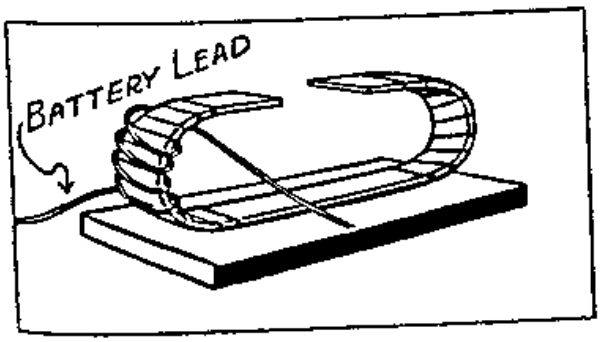
The winding for the other pole is applied in a similar manner, allowing a 12" battery lead and winding in a clockwise direction The finish wire, 12" long is to be wrapped around the other 4 penny nail, the brush part should point upward The two brush wires are spaced about ⅜' apart at the top Figure 9 shows how the field pole iron will look after the winding is completed with the brushes in place and the battery leads connected to the terminals of a battery



9 The field pole iron after winding is completed

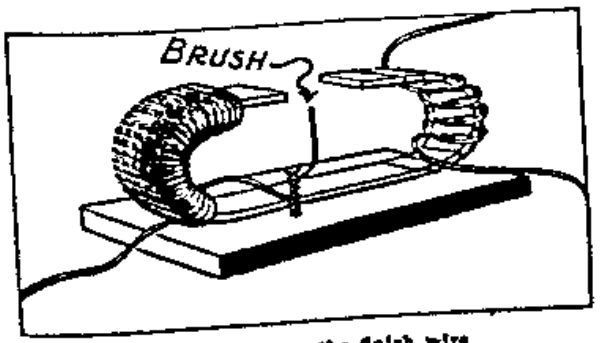
PREPARING THE ARMATURE We are going to prepare now what is called a two pole armature First drive the spike through the hole in the armature iron (Figure 5) The head of the spike should extend 1⅜' from the armature iron Next we make the commutator At a distance of 2⅜" from the head of the spike, wrap four layers of ¾" wide friction tape around the spike

We now make the bars for the commutator (Figure 10) The two bars are made of



7 Wrapping wire around the taped part.

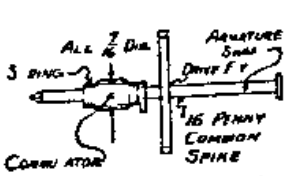
a single 3" piece of No 18 wire, which is prepared as shown in B, Figure 11, by means of a pair of long nose pliers Then the wire is bent and set on the commutator, as shown in C, Figure 11 Note that the two bars are opposite each other on the commutator, also that the central part of the wire is bent back so as to clear the spike The bars should be



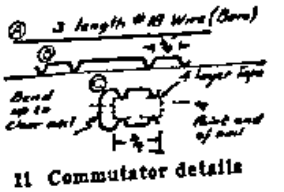
8. How to wrap the finish wire

located on the commutator so that they are in line with the leading edge (the longer edge) of the armature iron as shown in Figure 1 The bars are kept in place by means of string as indicated in Figure 10 Their overall diameter should be 7/16 When the armature is in the position shown in Figure 1 the brushes should make contact with the bars

HOW TO START THE MOTOR Connect the battery leads to the terminals of a dry-cell battery and give the armature iron a turn or two by hand This will start your motor going and it will continue to run as



10 Armature details



11 Commutator details

long as you have it connected to the battery More than one dry cell can be used if they are connected in series the motor will run faster and will be more powerful You will be able to operate toy machines with it by using a rubber band for a belt

WHAT MAKES THE MOTOR RUN? Suppose that the brushes of our motor are making contact with the commutator bars as shown in Figure 1 As the electric current passes through the coils of the field pole iron, it becomes a magnet The north pole of this

magnet will be opposite the north pole of the armature iron which will also be magnetized Since like poles of magnets repel each other the armature will start turning

As the armature moves the brushes lose contact with the commutator bars the circuit is broken and both the field pole iron and the armature iron lose their magnetism since no current is passing through the coils But the momentum of the armature keeps it turning until the brushes make contact again with the commutator bars Again the field iron and the armature are magnetized again like poles are brought into contact and repel each other and the armature continues to turn This process is repeated as long as the electric motor is connected to the battery

Article and illustrations prepared by the Westinghouse Electric Corporation

A USEFUL BOOKSTAND

THE bookstand described in this article is quite easy to make Figure 1 shows how it will look when it is completed Figure 2 gives the necessary working drawings The dimensions of each part of the bookstand are given in the drawings If you would like to have a smaller or larger stand change the dimensions accordingly

You may use a hardwood like oak beech or birch for the bookstand However such woods are rather difficult to work A soft wood such as pine or spruce is easier to handle After the stand is completed it may be stained to imitate any of the more expensive and harder woods

The first thing to do is to cut out to the exact dimensions the various pieces of wood required for the stand These pieces will include the four legs the rails or crosspieces connecting the legs five shelves eight slats four on each side After cutting the pieces finish them carefully with a plane so as to have them smooth and true Then rub them with sandpaper

The legs must be strong the finished size should not be less than 1¾ inches Each side piece is to consist of four slats fitted into the side rails by means of slots cut into the rails The shelves and rails are to be fitted into the legs of the bookstand by means of mortise-and tenon construction That is mortises or holes are cut in the legs with a chisel then the ends of the shelves and rails are cut so as to fit into these holes Figure 3 shows the principle of mortise-and tenon construction

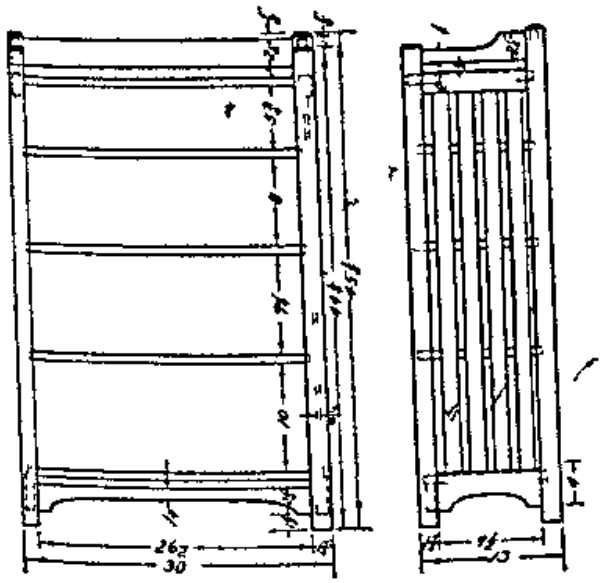
When all the pieces have been prepared we should first put together the side pieces, consisting of the slats and cross rails The slats are fitted into the appropriate slots after the parts which are to come into contact have been given a thin coat of wood glue When you have finished a side piece



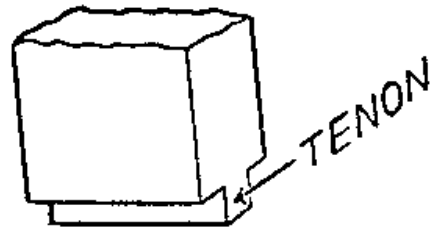
1 This is the bookstand described in the article Working drawings are given on the next page

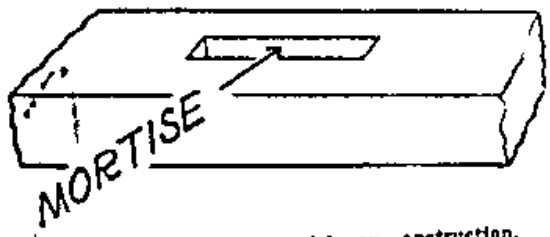
place burlap or a similar material around the top and bottom rail so as to protect the finish Then wrap cord around them in order to keep the various parts of the assembly under pressure until the wood glue has had a chance to set

When the side pieces have been completed you are ready for the final assembly Mortises and tenons should be coated with wood glue before being set in place When the assembly has been completed keep it under pressure until the glue has set



2. Working drawings to be used in making the book stand Left front view Right side view





3. Details of mortise and tenon construction.

If you have used a soft wood it may be stained any appropriate color Mahogany rosewood walnut and ebony stains are all very effective Give at least two coats of the stain which is to be applied with a brush If you wish to give the bookstand an extra fine finish you may apply French polish after all is dry When the bookstand is finished you will have an article of furniture of which you may well be proud

A PROBLEM FOR YOUNG DETECTIVES

MR TAYLOR the owner of a factory was about to leave on a business trip on October 1 1945—it was a Monday He was very much surprised to see Jack Smith the night watchman enter his office He was even more surprised when Jack begged him not to take this trip

Why not? asked Mr Taylor

Because last night I had a terrible dream You know, Mr Taylor I always have my one night off on Saturday Well I dreamed that it was Saturday and that I had gone to the movies in the evening to see the last show—I always do that on Saturday I noticed that an old man with a flowing white beard was sitting next to me Suddenly he turned to me and said Tell Mr Taylor not to take that trip on Monday or he will surely die Then he jumped up and before I could say a word to him he had left the theater I rushed right out after the old man but by the time I reached the street he had disappeared None of the bystanders had seen a man with a white beard leaving the moving picture theater

I remember that in my dream I was very much worried I begged you not to leave on your trip but you only laughed at me Suddenly I found myself standing by a railway track A train came speeding by No sooner had it passed me than it left the rails and soon it was a mass of wreckage I ran up to the scene and saw you lying dead by the tracks

Please Mr Taylor don t go! I know that this dream was meant to serve as a warning to you Something terrible will happen to you if you go today

Mr Taylor paid no attention to the warning of the night watchman He left on his trip as he had planned There was much anxiety among Mr Taylor s employees because the night watchman told everybody about his dream To everybody s relief Mr Taylor returned safely from his trip—and promptly discharged the night watchman

Why? With the clues that we have given you above you should be able to tell We give the answer in upside-down type on page 384

HOW TO MAKE AN APRON



Frank M Hoffman

1. It is easy to make this attractive apron

HERE is an apron which is very easy to make and yet is pretty and practical, as Figure 1 shows The amount of material to be used will depend upon the size of the girl for whom the apron is intended For size ten you will need about ¾ of a yard of material, 35 inches wide The apron will look well in a flowered, plain or checked cotton fabric

STITCHES TO BE USED

(1) Back stitch (for seams and for joining pieces together) Take a small stitch Take a second stitch back over first one bringing the needle to the right side of your material, the length of the first stitch that was taken

(2) Hand hem (for hems) Fold material to width needed for hem, allowing a little so that the edge of the material may be turned under Press edges of hem with fingernail so as to make a crease, pin the hem down Then begin the hand hem Take a single stitch through the material just below the fold of the hem Without drawing the needle through, push it upward just back of the edge of the hem fold Draw the needle through and repeat

TOP PIECE

With a tape measure take the measure from the waistline (or from the belt or sash of the dress) to the base of the neck Cut out a square piece of cloth, each side of which will have the above dimension Make a ½ inch hem on all four sides, using the hand hem

BOTTOM PIECE

Measure from the waistline down to the bottom of the dress Add 1½ inches to this Then measure around the waist from one side seam of the dress to the other side seam Cut out a piece of material using these two measurements Make a ½-inch hem on all four sides, as for the top piece

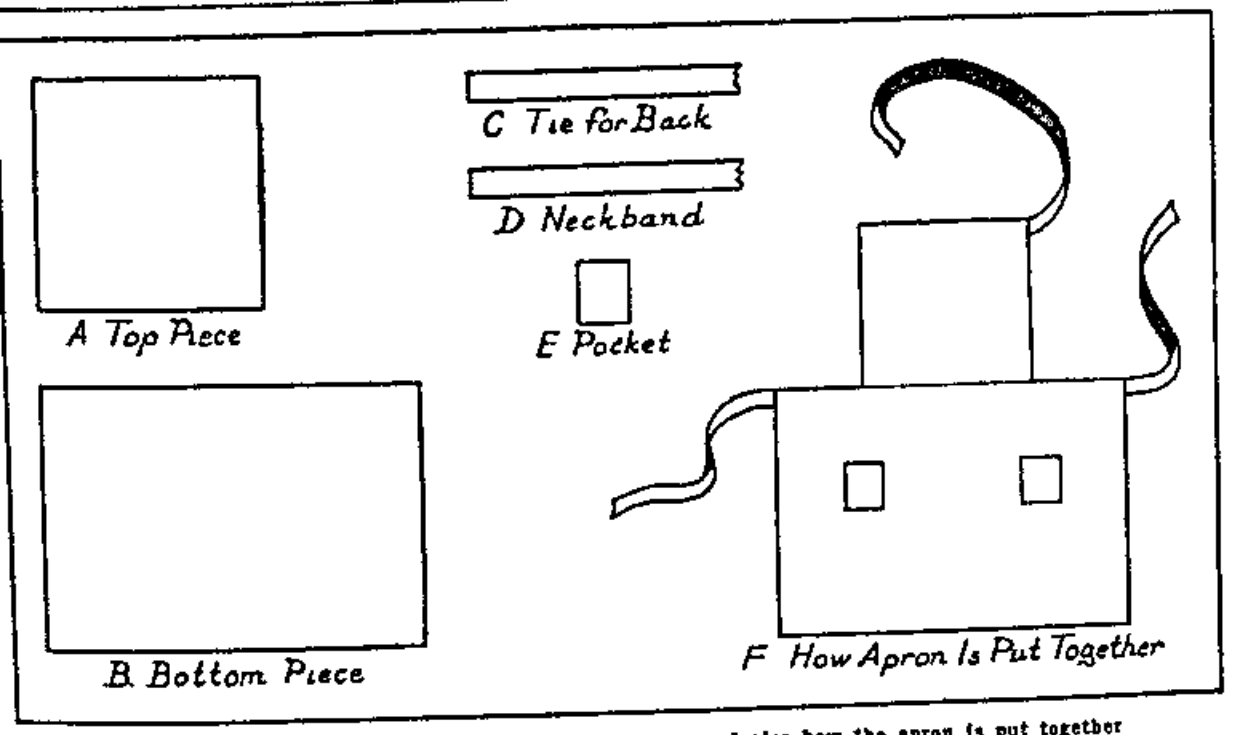
Join the top and bottom pieces together, putting the bottom of the top piece under the top of the bottom piece (See T, Figure 2) Use the back stitch

TIES FOR BACK

Cut out two strips of material 2½ inches wide and long enough to tie into a bow in the back when joined to the upper edges of the bottom piece Fold each strip down the center of the length so that the strip will be half as wide as before, but of the same length Using a back stitch, sew the edges of the long side together, also sew together the edges of one of the short sides Turn the strip inside out so that the seams will not show Turn in the material ⅛ of an inch on the other short side, and stitch the edges together When both strips have been prepared in this way, join them to the bottom part of the apron, as shown in T, Figure 2 Use the back stitch

NECKBAND

Passing the tape measure around the neck, measure from the top right edge of the top piece of the apron to the top left edge Add 2 inches to this measurement Cut a strip of this length 2½ inches wide and prepare this strip as you did the ties for the back Now join the neckband to the upper left edge of the top piece Place the neckband under this



2. This drawing shows the various parts of the apron and also how the apron is put together

top piece as far as the hem, and sew it down with the back stitch Sew on part of a snap on the other end of the neckband Sew the other end of the snap on the top right edge of the top piece, setting the snap on the hem

POCKETS

Cut out two pieces of material 4 inches by 3 inches Make an inch hem on one side this is to be the top of the pocket Hem under the other three sides ¼ of an inch Then sew the pockets to the bottom part of the apron Place the bottom of each pocket halfway down the bottom part of the apron and halfway between the end and middle of the apron Use the back stitch

A RECIPE FOR PINWHEEL COOKIES

YOU will need

1 cupful butter or other shortening
½ cupful sugar
1 egg yolk
1½ cupfuls flour
⅛ teaspoonful salt
1 teaspoonful baking powder
3 tablespoonfuls milk
1 square unsweetened chocolate

Cream the shortening that is work it with a fork until it is light and fluffy It will be easier if the shortening is at room temperature when you begin Add sugar gradually and continue working the fork around until shortening and sugar are well blended Beat egg yolk slightly and add to sugar and shortening Beat mixture well

In another bowl sift flour once, measure add baking powder and salt and sift again Add this mixture to the first gradually putting in some milk each time and mixing well after each addition

Divide dough into two equal parts putting each in a separate bowl Melt the chocolate in the top part of a double boiler and add it to the dough in one bowl Mix the dough and chocolate thoroughly

Put both bowls in the icebox for several hours Remove and work each batch of dough into a rectangular sheet ⅛ inch thick Place the plain sheet over the chocolate sheet and roll both up as for a jelly roll Put roll in wax paper and return to icebox for several hours, or overnight

Remove from wax paper and slice the roll making slices ⅛ inch thick Place on greased cookie sheet and bake in a moderately hot oven (375° F) for about ten minutes



Wilfred Walsh

This damp terrarium is provided with a glass cover to keep the frog and cricket from escaping. Most of the plants shown here will thrive even when the air is so damp that beads of water form on the glass and the leaves.

MINIATURE ZOOS AND GARDENS

By Thomas Gordon Lawrence

HOW would you like to have in your own home a tiny jungle or a dwarf-cactus garden, a refuge for tree frogs or a laboratory where you can study the fascinating habits of ants? All that you have to do is to construct an appropriate terrarium (pronounced teh rayr' ih um, the plural is terraria). A terrarium is an enclosed place where you can keep living things. It is much like an aquarium except that instead of being filled with water it is intended for plants and animals which live on land.

Let me tell you about a terrarium which a girl once made in a glass tumbler. In this she kept half a dozen coleus plants and orange seedlings alive for two years! Before planting the coleus and baby orange trees she put about an inch of brightly colored pebbles in the bottom of the glass and then put a half inch layer of soil and sand on top of the pebbles.

In order to have a "lawn" underneath the plants she placed a little piece of moss covered wood on the soil. To have some animal life in the terrarium she captured half a dozen tiny white insects called springtails which were hopping merrily over the wood and she put them in with the plants. She set a flat piece of glass over the top of the tumbler and kept it in place by means of Scotch tape. She did not water the plants for many months after the first watering had taken place.

Two years later all of the plants were still alive. The orange trees had grown to the top of the glass (about five inches). The coleus had grown until its stems were bent and twisted, because it had not had enough room in the glass. From the sides of the coleus stems delicate white feathery roots grew right out into the moist air, and the moss had grown much larger than it usually does in the woods. The original springtails had died of old age but their great great grandchildren still hopped about like little white grasshoppers.

Another terrarium which lasted a long time was made by a boy who wanted a home for a horned toad which his father had brought him from Texas A horned toad is not really a toad it is a lizard which lives in desert regions So the boy decided to make the terrarium as much like a Western desert as he could

He was lucky enough to have an old aquarium two feet long and a foot wide First he cleaned the aquarium very carefully Then he put a two inch layer of pebbles and broken pieces of flower pot all over the bottom Over the pebbles and flower pot fragments he put a thin layer of soil then an inch of clean sand over the soil Here and there he placed particularly handsome stones on top of the sand, and at one end of the terrarium he piled up a "mountain' of gleaming white pebbles

"DESERT VEGETATION" THAT A BOY OBTAINED FOR HIS TERRARIUM

Now came the problem of getting the right kind of desert vegetation Fortunately the boy was able to buy some small prickly pear cactus and an aloe He planted these with only a little soil to cover the roots or cut stems He wanted a thicker growth of plants in one part of the terrarium—such a growth as one might see in the brief rainy season in the desert So he went into the garden and got some weed and flower seeds Some of the small weeds looked quite beautiful when they grew behind glass The boy did not put any cover over the top of the terrarium as he was not afraid that the horned toad would climb out over the glass side and he knew that it needed a free circulation of air

The terraria that we just described are examples of the two principal kinds—damp and dry The girl had made a damp terrarium the boy a dry one In damp terraria the air is kept moist A glass cover must be provided and must be kept in position most of the time in order to seal in the moisture A dry terrarium is not really dry, but it has much less moisture than a damp terrarium Dry terraria are sometimes provided with glass covers sometimes they are left uncovered

SOME IMPORTANT RULES TO FOLLOW IN MAKING A DAMP OR DRY TERRARIUM

There are some general rules to follow, whether you are making a damp or dry terrarium Almost any glass vessel will serve—an old drinking glass a glass bottle a glass preserve jar The best thing for the purpose however is a rectangular aquarium which you can buy in any store that sells tropical fish In general the thinner and clearer the glass the more beautiful the plants and animals will appear

IT IS IMPORTANT TO HAVE GOOD DRAINAGE FOR THE PLANTS IN A TERRARIUM

Always put a layer of pebbles or broken crockery on the bottom This allows surplus water to drain down and insures a supply of life giving oxygen for the roots of the plants On top of the pebbles or crockery fragments put a half inch or inch layer of soil or sand This is all that is needed even for large plants if the terrarium is kept constantly covered If your terrarium does not have a glass top you will have to have a little more soil You will rarely need more than 1½ inches

Keep the glass so clean that it sparkles Sometimes your terrarium will become far more attractive if you put a piece of white cloth or white paper behind it The cloth or paper will cause light to be reflected into the terrarium and make its details much clearer If a growth of green algae covers the glass, simply wipe it off with a cloth Use white sand or marble chips to cover part of the soil if the terrarium looks dark or dingy Fragments of red brick will also brighten up its appearance

TOO MUCH HEAT MAY PROVE FATAL TO BOTH PLANTS AND ANIMALS

The greatest enemy of life in a terrarium is TOO MUCH HEAT Keep your terrarium away from hot stoves or radiators If you have animals in it, there is danger that the rays of the summer sun coming in through the window will raise the temperature to such a point as to kill all animal life Curiously enough most of the light rays that enter a terrarium turn into another form of energy—heat—when they hit the soil Now the light can pass in and out freely but the heat passes out through the glass very slowly Therefore the temperature inside a terrarium may be very hot when the room is only pleasantly warm

When it gets too hot inside a terrarium the growth of molds and bacteria is stimulated and the plants lose their resistance to fungus infection Some plants (like most grasses and pine and cedar seedlings) can be kept inside a closed terrarium only if the temperature inside remains low Otherwise their green leaves become covered with cobwebby mold almost overnight

The next greatest danger to both plants and animals is one of two opposites TOO MUCH WATER and TOO LITTLE WATER If your terrarium is a closed one (one with a glass cover on top) you may not have to water it again for weeks or even years if you put in the right amount of water at first The amount of water you put in depends on what kind of growth you wish and also on whether you want a damp or dry terrarium.

SOME TERRARIUM PLANTS REQUIRE MUCH MORE WATER THAN OTHERS

If you are going to raise cactus or other succulents (plants with fleshy stems or leaves) in a closed terrarium you should put in very little water so that practically no mist ever forms on the inside of the glass For ordinary plants more water can be put in so that a definite mist forms on the glass whenever it is chilled Still more water should be added if you are making a damp terrarium If you wish to raise delicate mosses and ferns in their greatest beauty the interior should be so moist that big drops of water hang occasionally from the glass cover

If you have an open terrarium (one without a glass cover) you must watch it carefully and water it as soon as necessary If you have a good foundation of pebbles you will be able to see the water running down between the stones and there will be no danger of the soil becoming water logged Soon green algae and perhaps moss will grow between the stones It is not necessary to clear away this growth it will do no harm to your plants

The very best plants for a damp terrarium come from the depths of the forest They are the mosses ferns and small woodland flowers Cut flowers when placed in a damp terrarium will last many days longer than in the open air generally they will be much more beautiful too

Practically all the plants of your garden and the neighborhood roadside will grow in a dry terrarium The best plants for this purpose however are the prickly pear cactus and the aloe When we speak of cactus plants we generally have the prickly pear cactus in mind (The eagle on the flag of Mexico is perched on a prickly pear) A good thing about cactus and other succulents is that when you want a new plant all you have to do is to cut off a part of the old one You let the cut base of the stem dry for a day or two then you plant it just barely covering the base with soil or sand

The aloe which is a native of Africa and Arabia and is related to the bitter aloes mentioned in the Bible is perhaps the best of all plants for dry terraria It has long smooth fleshy leaves with a row of teeth on each side The leaf holds so much water that if you cut a leaf and squeeze it drops of water spurt out as if from a fountain Aloes produce numerous small plants growing from the base of the old one so that you soon have a number of new plants in addition to the original one

Some plants are very adaptable and grow well in either a dry or damp terrarium among these are the coleus and the begonia Orange lemon and grapefruit seedlings will grow beautifully in either dry or damp air but they need a good supply of water for their roots Chickweed the dainty weed with the star like white flowers grows vigorously beside cactus and aloe on fairly dry sand It grows even better with larger flowers in a terrarium so damp that the leaves of the plant are always beaded with big drops of water

ANIMALS LIKE PLANTS, VARY IN THEIR ABILITY TO STAND DAMPNESS

In selecting animals and insects for your terrarium you must remember that like plants they vary in their ability to stand dampness It is impossible to have the air too moist for frogs salamanders earthworms and pill bugs On the other hand snakes lizards and most insects do much better in a rather dry atmosphere For example grasshoppers are attacked by white fungus and die in a few days if the air in their terrarium is very moist

ANSWER TO THE PROBLEM ON PAGE 379

We know that the night watchman had his one night off on Saturday That meant that he was supposed to be working every other night But if he had a dream on Sunday night he must have been asleep at the time That is why Mr Taylor discharged him

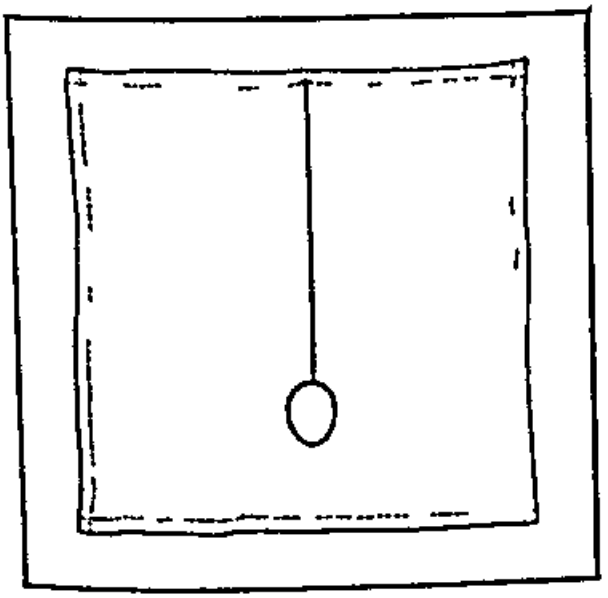
THE MYSTERY OF THE DISAPPEARING EGGS

HERE is a feat of magic that will amaze any audience We ask if someone will be kind enough to lend us a hat—a man s felt hat or any hat with a deep crown We set the hat with the brim upward on the table in front of us Then we pull a handkerchief from our pocket and show the audience that it is a perfectly ordinary handkerchief with nothing hidden in it

We hold it up by the two upper corners so that the bottom is just about two inches from the brim of the hat We gradually draw the two upper corners together and—wonder of wonders—an egg comes out and drops into the hat

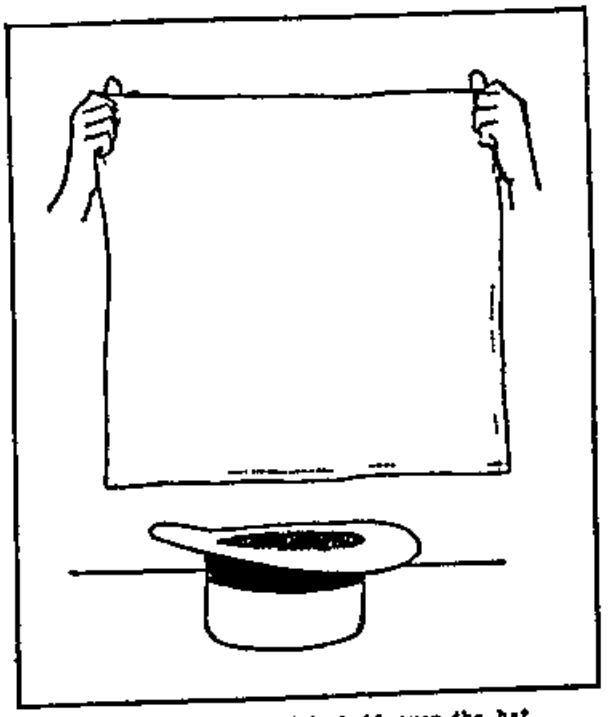
We straighten out the handkerchief then draw the two corners together again and an other egg drops into the hat We continue in this way until the hat contains half a dozen eggs Then we fold up the handkerchief and put it in our pocket

We pick up the hat very carefully bring it over to the person who lent it to us and then suddenly put it on for him When our friend removes his hat the audience expects to see his hair covered with a wonderful mix ture of egg shells egg yolk and egg white Not at all! The eggs have disappeared from the hat and there is no trace of them What has happened?



1. How the egg is attached to the handkerchief

Yes of course, this is a trick We shall need not a half dozen eggs but just one—a white one—for our performance It is to be prepared for the trick in the following way First we pierce the shell at opposite ends with a darning needle Then we enlarge the hole at one end by picking away at its edges with the point of the needle until the hole

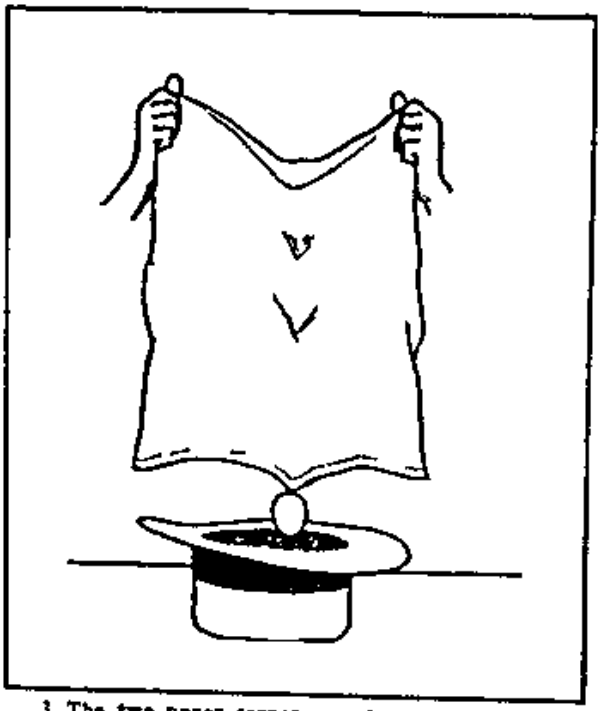


2. The handkerchief is held over the hat.

has a diameter of ⅛ inch We place the egg over a saucer and we blow through the smaller hole causing the contents of the egg to come out through the larger hole

We now take a piece of white thread about fifteen inches long knot one end and insert the other in a needle We pass the thread through a piece of white paper about ½ inch square We dip the paper in mucilage then fold it so that it will pass through the larger hole When we have passed it through the hole we pull lightly on the thread so that the mucilage-covered paper is brought into contact with the under side of the egg When the mucilage is dry, the thread will be firmly attached to the egg

We sew the other end of the thread to the hem of the handkerchief as shown in Figure 1 When the egg hangs down as shown it should extend to about three inches from the opposite hem This is a view of the handker chief that the audience will never have if you can help it because the egg will always hang on the side away from the spectators You should use a very heavy linen handker chief so that nobody will be able to make out the outline of the egg through the cloth A napkin would be even better if small enough to be mistaken for a handkerchief



3. The two upper corners are brought together

We perform our trick standing behind a table The members of the audience should be at least three feet away from the other side of the table or else they may be able to detect the trick When we are about to begin the performance the napkin and egg are resting in one of our pockets in such a way that as our hand reaches into the pocket it can grasp the egg Naturally you must be careful not to crush the egg

Concealing the egg in the palm of the right hand we now draw out the handkerchief Still keeping the egg hidden we hold out the handkerchief as in Figure 2 we convince the audience that there is nothing hidden in the handkerchief Still holding out the handkerchief with the prepared side away from the audience we let the egg fall into place We now hold the handkerchief over the hat with the bottom of the handkerchief about two inches from the brim (Figure 2)

We bring together the two upper corners of the handkerchief as shown in Figure 3 This causes the egg to drop until it is in full view of the audience under the handkerchief We lower the hat until the egg is lying in the bottom of the hat Then we draw apart the two upper corners again and raise the handkerchief until it is again in the position shown in Figure 2 We repeat the performance a half dozen times By that time (at least that is what the audience will think) there will be six eggs in the hat

Now we bring together the two upper corners of the handkerchief so as to conceal the egg in the fold Then we put the handkerchief in our pocket We then complete the performance by picking up the hat and placing it on the owner s head

To present the trick most effectively you should practice it over and over again Of course you must be careful at all times not to crack your egg Professional magicians generally use a celluloid egg for tricks of this kind since it is not so fragile Celluloid eggs are inexpensive You may buy them at magic shops and in many stores that specialize in novelties

THE GAMF OF DOUBLETS

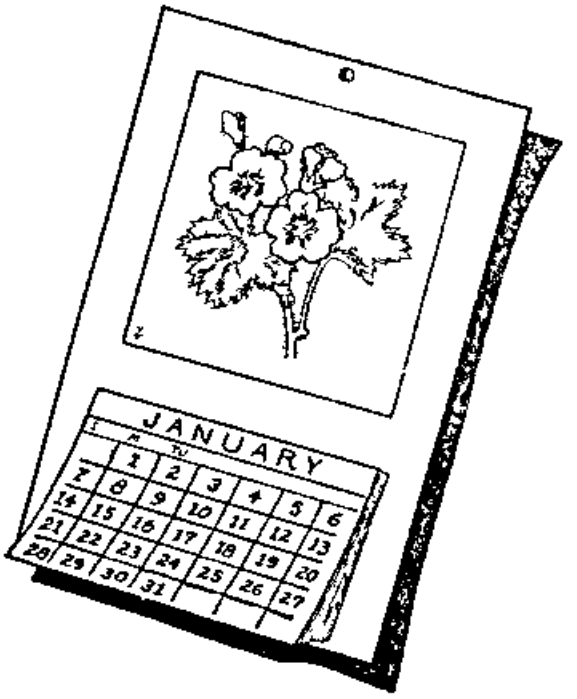
TO play this interesting game we choose two words opposite or quite different in meaning each containing the same number of letters Since they come in pairs we call them doublets Here are some examples of these doublets Black—white right—wrong good—evil beef—pork

The game consists of turning one of these words into the other by changing only one letter at a time thus making a chain of words between the doublets Following is an example of such a chain

black—white
black
slack
stack
stalk
stale
shale
whale
while
white

You will note that only one letter is changed in each word to make the next Only words that you can actually find in the dictionary can form part of the word chain Again in changing one letter to make a new word in the chain the substituted letter must occupy exactly the same position in the word as the letter that we have taken out That is we must not have a chain containing a series like 'heal earl, lure

Garden Lover's Calendar



Compiled by

Elizabeth Peterson

January 1 15

Most house plants require little water dur ing this month However plants should not be allowed to dry out Plants in small pots will probably dry out quicker than those in large pots Those which are growing rapidly and flowering quickly will dry out most rapidly The best test to determine whether or not the plant needs water is to rap the pot sharply if it gives a ringing sound the plant is dry

Seeds which have been left over from the past season should be tested carefully before they are planted A satisfactory way to test them is to sow a few seeds in small flats label ng each kind carefully and also indicating the number of seeds of each kind that have been sown

January 16 31

An occasional sprinkling overhead or d p ping in a tub of water will serve to remove dust from the foliage of ferns grown in the house and will promote their healthy growth Palms should be sponged

Spraying with lime-sulphur (one part lime sulphur to twelve parts water) during warm winter weather is the most effective method of ridding fruit trees and shade trees of scale pests

The following house plants will grow well in a warm room palms ferns cactus plants and fig plants They grow best in a tempera ture of 65 to 70 degrees in the daytime and 60 to 65 degrees at night

February 1 15

Begonia plants should be potted in Feb ruary or March Place a dash of sand under each bulb place the pots in a box of wet ashes or sand extending to the rims of the pots and put away in a cool part of the cellar When the plants show signs of growth bring them into the light but do not supply them with too much water until they become well rooted

February 16 28 (29)

Twigs of the willow maple elm hickory cherry and crab apple may be brought in doors for winter decoration

Daffodil bulbs that have been forced dur ing the winter should be planted as soon as the frost is out of the ground

Keep window boxes that are filled with evergreens well watered during the winter months Even if ice forms around the plants no harm will be done to them

March 1 15

It is best to repot palms and similar house plants at this season so that they will be ready to make their annual growth in the summer Use a pot one size larger Ram the soil around the edges very tightly with a stick—so tightly in fact that the pot will not drop away when the palm is lifted by its leaves

Plant dahlia tubers in peat moss and as soon as the sprouts have made several inches of growth cut them off and set them in sharp sand

March 16-31

As soon as all danger from frost is past remove the dead leaves and stalks from

around the perennial plants (plants which continue to live from year to year) Spray new growth with Bordeaux mixture to prevent fungus disease

The seeds of slow growing annuals (plants that live only for one growing season) such as zinnias pot marigolds petunias asters and heliotrope should be started in boxes of earth or in pots in the house or elsewhere in hotbeds

Prune old rose bushes when the weather is not too cold cutting away all dead wood

April 1 15

All early sown plants should be hardened off in the cold frame before they are moved to the open ground

Clean the lawn of weeds fill in the holes with fresh soil and seed over all the bare spots

Perennials should be planted as soon as they can be handled in workable soil

Stake and wire newly planted trees to prevent them from swaying in high winds Water all newly planted trees and shrubs at frequent intervals

April 16 30

Do not scrape the bark of trees to destroy injurious insects for great damage may be caused to the cambium layer

Pansies daisies and foxgloves that have been carried over the winter in cold frames can be moved into beds or borders now to make room in the frames for the early planting of the tender perennials

With the exception of the magnolia which may be moved in May all deciduous trees and shrubs (that is those that lose their foliage every year) should be transplanted as soon as possible

May 1 15

Evergreens can be transplanted later than deciduous trees but do not neglect to soak them with plenty of water every other day for several weeks after they have been moved

Peonies require plenty of water while the buds are being formed early in May A spray of one pound of blue stone and one pound of lime to fifty gallons of water applied when the buds are the size of buckshot will prevent blight and early applications of bone meal will supply nourishment

May 16 30

Best results in destroying weeds are obtained by sprinkling a good weed killer over walks and drives and washing it in with the hose It is better to soak the paths or roads with water before applying the weed killer or else to apply it after a heavy rain

Daily sprinklings of the lawn will bring the grass roots to the surface of the soil It is better to give the lawn less frequent but heavy soakings

Bone meal can be used with good effect around perennials including roses The latter respond well to applications of liquid manure when they are coming into bloom

June 1 15

June is the ideal month for planting dahlias either tubers or green plants The clumps should be separated leaving a part of the neck with an eye on each tuber and the tubers should be planted six inches deep on their sides

Petunias and forget me nots make good fillers for rose beds because they do not draw much nourishment from the soil

If peony buds are cut off before they break open and placed with their stems in deep water in a cool cellar they will form better flowers The buds should be soft to the touch when they are cut

June 16 30

Cut off the old flower heads on lilacs and break off those on rhododendrons without removing any of the branches

The following annuals make good potted plants for porch or terrace decorations petunias annual larkspur snapdragons heliotrope and mignonette

Plants with lice on them should be sprayed with a nicotine preparation This should be done as soon as the insects have been noticed on the plants

Spray evergreens with lime sulphur

July 1 15

Thin out the old wood of shrubs that have finished blooming

Stake tall perennials before they begin to bend and break Tie them with raffia or keep them confined in wire hoops

Lawns should not be cut as closely now as in the spring Remove clippings as they mat between the grass and hinder growth

Sweet peas will continue to flower if no blossoms are allowed to go to seed if they are well watered and if they are heavily mulched to keep the ground cool (A mulch is a covering of straw, leaves or other substance spread upon the ground to protect the roots of plants)

July 16 31

The tarnish plant bug that punctures the growing tips of asters in hot weather can be kept in check with a tobacco spray or by dusting with air slaked lime

To rid nasturtiums, sweet peas and golden glow of the pest called the aphis, spray with a nicotine preparation

The best way to obtain winter blooming geraniums is to start slips or cuttings in June or early July Grow the plants in pots shifting them to larger pots as they develop

August 1 15

Crab grass, worst of all lawn pests, will be seeding soon Rake the lawn before mowing to bring up all seed stalks so that they may be cut off Sweep off all lawn clippings where crab grass is present

Hardy fall chrysanthemums will flower best if they are heavily watered and well fed with liquid manure or other fertilizer

August 16 31

Water all plants during a period of drought until the ground is saturated not less than four inches in depth Never spray them when the temperature drops suddenly or when northeastern winds are blowing for this causes mildew

Take cuttings of English ivy, poinsettia and heliotrope and pot them up for house plants for next winter

September 1 15

If lily-of the valley plants have become overcrowded the entire bed should be dug up at this time and the larger pips or roots reset two or three inches apart and just under the surface

Divide and plant peonies this month so that they will become well established before the bad frost Select strong divisions with three to five eyes and set them with the topmost eye not more than two inches below the surface

Withhold plant food from the rose garden from now on, but keep the soil well mulched

September 16 30

Chrysanthemums should be staked given liquid manure and sprayed or dusted with a nicotine preparation

Dwarf asters may be taken from the garden and set into small pots for flowering in the house The ground around these plants should be thoroughly watered an hour or two in advance and the pots should be placed in a sunny window

Purchase house plants from the florist as soon as possible so that they will become gradually inured to the dry house air while the windows may still be left partly open to admit fresh air

October 1 15

Tulips daffodils and hyacinths which are to be forced indoors must be buried in a trench outside or kept in a cold frame or a cool cellar for several weeks until root growth has been started

Be sure to plant bulbs right side up Most spring blooming kinds have a pointed top and a kind of ring at the bottom where the roots were attached Lily bulbs have scales pointing toward the top and should be tilted slightly so that water will not lodge in the scales and cause them to rot The bottom of a crocus bulb is slightly depressed

October 16 31

Several of the ferns which grow wild in the woods make very good house plants They should be taken up after the frost has destroyed the tops but before the ground has been frozen It is best to leave them in a large pot until they freeze solid and to take them indoors early in December

Rock gardens may be constructed at this late date but it is advisable to delay planting until next spring This will give the rocks and soil a chance to settle so that when the plants are set out there will be no air pockets to dry their roots Rock gardens recently planted will need careful winter mulching with salt hay evergreen boughs and the like

November 1 15

After the hardy chrysanthemums are through flowering cut them back to within a few inches of the ground If this is done heavy shoots will appear in the spring these will be excellent as cuttings

Bulb plants and perennial borders should not be mulched until the ground is well frozen Otherwise a nesting place for mice will be provided

This is the ideal time to plant tulips Cover them five inches deep space the bulbs five inches apart Do not locate beds of bulbs under eaves or where water will collect during the winter months

November 16 30

Cover the bulb beds with a light litter when freezing weather has set in Crocus bulbs should not be too near the top or they will heave and will be easily dug out by mice

Stagnant surface water from melting snow during winter months is dangerous to perennials This condition may be prevented in many cases by digging shallow ditches to carry off this surface water

Windbreaks to be set around rhododendron beds and exposed evergreens should be put in place before the ground freezes Painted wooden barricades or burlap stretched over wooden frames are desirable

December 1-15

Seeds collected from the garden must be kept dry over winter Stout paper bags or envelopes are best Each of these should be plainly marked and arranged alphabetically in boxes

When the ground has become stiffened with frost, give all evergreens especially those transplanted late this fall, a heavy mulch of straw or well rotted manure

Heliotrope seed may be sown this month, it will germinate very slowly

December 16-31

Tubbed bay trees, box bushes and hydrangeas are best stored in a dark, cool well ventilated cellar that is frost proof Water them only occasionally

Lilies bulbs and rose beds should now receive their winter mulch Cover with peat moss or buckwheat hulls

All garden statuary that is movable should be stored away Otherwise it should be covered over with watertight boxes, particularly if it is of soft stone

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A NATURAL HISTORY QUIZ

(1) Do fish sleep with their eyes open?

(2) Does the kangaroo run when it is frightened?

(3) "Among the insects that feed on other insects are the dragon fly the giant water bug the spider and the wasp What is wrong with this statement?

(4) Is the mane of the lion lighter or darker than the rest of its body?

(5) Is there a bone in the trunk of the elephant?

(6) Is the horned toad a frog?

(7) What insect keeps a herd of cows and milks them?

(8) What large animal is dumb?

(9) Does a porcupine throw its quills when it is attacked?

(10) What member of the cat family is trained to hunt like a dog?

(11) Could you take a ride on a sea horse?

(12) 'The clothes moth eats woolen clothing ' What is wrong with this statement?

(13) Can you name a large town in antiquity that was set on fire by fireflies?

(14) What tree is grown to provide food for an insect?

(15) When is an artichoke not an artichoke?

The answers to the above questions are given upside down on this page

ANSWERS TO NATURAL HISTORY QUIZ

(1) Yes, because they have no way of closing them (2) No it moves by leaps and bounds (3) The spider is not an insect (4) Darker (5) No, the elephant's trunk is made up of a mass of muscles (6) No, the horned toad is a lizard (7) The ant Ants keep 'flocks' of aphids When an ant strokes an aphid with its antennae, a sweet substance, called honeydew, oozes from the hind part of the aphid's body The ant feeds on the honey dew (8) The giraffe (9) No The quills come out very easily, but the porcupine can not throw them. (10) The cheetah it is trained in this way in India (11) No, the sea horse is a tiny fish with a head shaped like that of a horse (12) It is not the moth that eats garments, it is the larva the wingless young of the moth (13) The answer is "No" Fireflies could not set fire to anything For one thing, the light of the firefly is inside its body, besides, it is a cold light (14) The mulberry tree The silkworm is fed on the leaves of the mulberry tree (15) When it is a Jerusalem artichoke This plant is a sunflower, but its potato like tubers taste very much like artichokes

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Alexander, Sir Harold R L G (1891), governor general of Canada During the war he served as Allied Supreme Commander in the Mediterranean theater, where at one time he had a Canadian corps under his command He was the last man to leave Dunkirk when the British and French troops were evacuated in 1940 A son of the Earl of Caledon, he was educated at Harrow and Sandhurst and served in France during World War I
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Arnold Henry H (1886) commanding general of the United States Army Air Forces During the war he served as a member of the Joint United States Army and Navy Staff and of the Combined Chiefs of Staff of Great Britain and the United States He entered the newly formed Air Force in 1911, and was taught to fly by the Wright brothers Late in 1945 General Arnold was awarded the Hubbard Medal for outstanding work in geography and Lord Halifax, British Ambassador, presented him with the Order of the Bath, one of Great Britain's highest honors
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Attlee, Clement Richard (1883-), prime minister of Great Britain and leader of the Labour party From the beginning of the Churchill Coalition Government in 1940 until its defeat at the polls in 1945, Attlee held a number of important posts in the Cabinet—Lord Privy Seal, Secretary of State for Dominion Affairs Deputy Prime Minister and Lord President of the Council On his election, he pledged that British foreign policy on international co-operation would not be changed He was

Attlee, Clement Richard (*continued*)
educated at Oxford, became interested in social service work and in politics
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B

Bach, Johann Sebastian, German composer, 142
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Bartók, Béla (1881 1945), Hungarian composer Outstanding in the field of modern music, he was a leader in the rebellion against the more romantic traditions of nineteenth-century music He studied in Budapest and while there wrote his Kossuth symphony, celebrating the great Hungarian hero At the same time he became deeply interested in Hungarian folk music, accumulating a tremendous collection, which in time influenced his own work It led him to the use of new harmonies and the adoption of a twelve-tone scale He chose exile in 1940, and his last five years were spent in the United States
Bascom, Florence (1863-1945), American geologist She was associated with Bryn Mawr College from 1895 on, retiring as professor emeritus of geology in 1928 An authority in her field, she contributed to a number of geologic periodicals She studied at the University of Wisconsin, and later received the degree of Ph D from Johns Hopkins University, the first woman ever to receive this honor from that institution
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Benchley, Robert C (1889 1945), American writer and actor He had the gift for making the most commonplace incidents seem wildly funny, as in the famous movie "short," How to Sleep, and the same droll view of life appeared in the hundreds of articles he wrote for such magazines as The New Yorker He was educated at Harvard, and entered newspaper work a few years later
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Blamey, Thomas A (1884-), commanding general of the land forces of the United Nations in Australia during the war, under the supreme command of General MacArthur He was present at the formal surrender of Japan aboard the U S S Missouri, September 2, 1945, and signed for Australia Late in 1945 he retired as chief of the Australian General Staff
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Bong Richard (1921 45), top American air ace of World War II He flew more than 500 combat missions against the Japanese and shot down forty Japanese planes during two years of Pacific combat, and was in the battles of the Bismarck Sea, Oro Bay, Buna, Wewak, Lae, Rabaul, Huon Gulf and Leyte Born and brought up on a farm near Poplar, Wisconsin, he won his wings at Lipe Field, Phoenix, Arizona, and rose to the rank of major His numerous decorations included the Congressional Medal of Honor Death came when a jet plane he was testing crashed, in California
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Buckner Simon Bolivar Jr (1886 1945) commanding general of the Tenth Army and most famous for his conduct of the Okinawa campaign It was during this action only a few days before the island was completely won that he was killed by a shell as his men drove the Japanese south Earlier in the war he was in command of the defense of Alaska and routed the Japanese from the Aleutian Islands He was born in Munfordville Kentucky and graduated from West Point During the Aleutian campaign he received the Distinguished Service Medal and rose to the rank of lieutenant general
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Byas Hugh (1875 1945) foreign correspondent and an authority on Japan As Tokyo correspondent for the London *Times* and the New York *Times* from 1926 to May 1941 he was an *eyewitness and faithful reporter of such* events as the conquest of Manchuria *and the war in China He was born and* educated in Scotland and early became *associated with British newspapers He* first went to Japan in 1914 and altogether spent twenty five years there.

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Cherniakhovsky Ivan Danilovich (1908 45) commander of the Third White *Russian Army* His troops were the

Chernakhovsky, Ivan Danilovich (*continued*)
first to set foot across the border of Germany proper, in East Prussia, where he received the wounds which resulted in his death He was the youngest general and Army Group commander in the Russian Army, and helped to drive the Nazis out of White Russia
Chiang Kai shek (1886) president of the Chinese Republic, and of the Kuo mintang China's chief political party The defeat of Japan left China a very much divided country, and conflict continued between Chiang s government and the Chinese Communists Toward the end of 1945 he called for a meeting of the People s Consultative Council an all party group to be held in January, 1946 It was hoped that this meeting would end China s internal strife Chiang was associated with Dr Sun Yat sen, who established the Chinese Republic
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Churchill, Winston S (1874), prime minister of Great Britain 1940 45 He was one of the most outspoken opponents of appeasing Germany in the critical years before the war and when the Chamberlin Government fell partly as a result of that policy, Churchill was called on to lead his country He warned the people that the cost of victory would be "blood, sweat, toil and tears" but his vigor, courage and indomitable will at last led them to victory The elections of the summer of 1945 were a defeat not of the man but rather of his party, the Tories He himself was re-elected to his seat in the House of Commons In order to remain there he refused the Order of the Garter, which carries knighthood and membership in the House of Lords with it.
Clark, Mark W (1896), head of the United States forces occupying part of Austria He is best known for the thrilling exploit in which he led a secret mission to get information in North Africa in preparation for the Allied invasion in
Clark, Mark W (*continued*)
1942, and as commander of the Fifth Army which fought its way north through Italy He was born at Madison Barrack New York, and graduated from West Point
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Cregar, Henry Duncan (1888-), commanding general of the First Canadian Corps overseas From 1940 to 1943 he was chief of the Canadian General Staff Hamilton, Ontario, is his birth place. and during World War I he rose to the rank of lieutenant colonel He has since held important positions in the Canadian Department of National Defense and was commandant of the Royal Military College at Kingston when the second World War began

Crew racing 290
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Crow Carl (1883 1945), American journalist and author of a number of well known books on the Orient He first went to China in 1911 as associate city editor of the China Press Shanghai and from 1919 to 1937 he owned an advertising agency there His books were written out of this experience The first of them to become a best seller was Four Hundred Million Customers published in 1937
Crucible process steel manufacture, 173
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Cunningham Andrew B, Sir (1883) Admiral of the Fleet First Sea Lord and Chief of the Naval Staff since 1943 He was commander in-chief of the Allied naval forces in the Mediterranean during the North African and Sicilian campaigns Cunningham Alexander and Tedder were the commanders respectively, of the sea land and air forces under the supreme command of General Eisenhower Cunningham served through World War I and commanded the British fleet in the Mediterranean from 1939 until the collapse of Italy
Cunningham, John H D C Sir (1885) commander in-chief of the Allied fleet in the Mediterranean In August 1943 he had been placed in command of the British fleet in the Levant and in October, 1943 he replaced Admiral Sir Andrew B Cunningham (a distant cousin), listed above Sir John entered the Royal Navy at an early age and by 1936 was Assistant Chief of the Naval Air Staff
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Curtin John (1885 1945) Australian statesman At his death he was prime minister He had held this office since 1941, when he also became Minister of Defense Co-ordination in his own cabinet This was the first labor government in Australia since 1932 He was born at Creswick Victoria and became a trade-union journalist From 1917 to 1928 he was editor of a labor paper the Worker, and published a long series of pamphlets on social and political problems.
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De Gaulle Charles (1890) French soldier and statesman When France surrendered to Germany in June 1940 he refused to accept his country s submission From London he rallied and led French soldiers sailors and airmen who escaped as well as the underground groups in France the Free French movement In 1945 he became president of the new French republic A graduate of Saint Cyr (the French West Point) he served in World War I and afterward strongly advocated a mechanized French army
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Doenitz, Karl (1892), chief in command of the German fleets from January 1943 when he replaced Admiral Raeder, till the end of the war Doenitz served in the first World War and became an expert on submarine warfare originating the "wolf pack" method of attack on Allied shipping At the end of 1945 he was being tried with other leading Nazis before an international war crimes tribunal
Dog shows, 291
Doolittle, James H (1898-), commanding general of United States air forces operating from Great Britain during the closing years of the war He became widely known in April 1942, when he led a bold raid by American bombers on Tokyo Following that exploit he commanded the Twelfth Air Force in Africa and Italy, when he was made a major general
Doublets game, 386
Draft, into Army, 323
Dreiser, Theodore (1871 1945), American novelist He was a pioneer in the writing of realistic fiction, presenting the grimmer side of American life and in the early 1900's his books caused considerable controversy Though his prose is heavy, without humor, his characters live Among the most noted novels are Sister Carrie, Jennie Gerhardt, The Financier, The Genius, and An American Tragedy
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E

Eaker, Ira C (1896-), deputy commander of the Allied air forces and chief of the Allied air staff in the closing months of the war in Europe, with the rank of lieutenant general In 1943 he was chief of the United States bombing command operating from Great Britain, and in December of that year was given command of all Allied air forces in the Mediterranean theater.
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Eisenhower, Dwight David (1890-), chief of staff of the United States Army He was in supreme command of the Allied invasion of Europe from the west and after V-E Day was commanding general of the American troops occupying Germany and American representative on the Control Council in Berlin In World War I he organized the United States tank forces Later he organized the Philippine Army and defenses under General MacArthur He was chief of the Plans Division under General Marshall when the United States entered World War II.
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Giraud, Henri Honore (1879) French army officer In 1942 he was the commanding general of the French armed forces in North Africa co operating with the Allies He had been taken prisoner by the Germans in 1940 but escaped
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Glasgow, Ellen (1874-1945) American novelist She was born and lived in Richmond, Virginia and her stories have a realistic Southern setting She rebelled against the over romantic tradition in Southern writing, and presented her characters more as people who might live anywhere Among her finest novels are Barren Ground The Romantic Comedians and Vein of Iron In This Our Life won a Pulitzer Prize and was made into a motion picture
Glass, for house construction, 264
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Goering, Hermann (1893), German army officer who was head of the German air forces and second in command to Hitler A German air hero of World War I, he was an early follower of Hitler though he belonged to the old Prussian military aristocracy Late in 1945 he was brought to trial for war crimes before the international tribunal in Nuremberg
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Halsey, William Frederick (1882) American naval officer who commanded the United States fleet in the southwest Pacific, under Admiral Nimitz He was in personal command of all the fleet operations which acting with General MacArthur s forces gained the various victories in the Solomon Islands area In December 1945 he was promoted to the five star rank of Admiral of the Fleet
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Hess, Rudolph (1896-), Nazi party leader who, until May, 1941, was considered Hitler's successor At that time he flew from Germany to Scotland on a mysterious mission, and was interned in England for the rest of the war At the end of 1945 he was being tried before the international tribunal in Nuremberg
Hevea tree, 245, 247, 253
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Hirohito (1901-), emperor of Japan For centuries whoever held this position was considered god by the Japanese people as the long line of rulers were supposed to be descendants of the Sun Goddess
Hirohito (*continued*)
  This religious aspect of the throne was carefully cultivated by the governing class to keep the Japanese people in subjection Late in 1945, however, Hirohito announced that his people were no longer to consider him a sacred personage
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Hitler Adolf (1889-), dictator of Germany From 1933 on he was absolute ruler of Germany, and his inordinate ambitions were chiefly responsible for bringing on World War II He served in World War I, and organized the Nazi party in the early 1920 s On May 1, 1945, just before the German collapse he was reported dead, but the report has not been proved *See also* 119
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Johnson, Hiram Warren (1866 1945), American political leader, born in Sacramento, California He served as Republican senator from that state from 1916 until his death He opposed the League of Nations and favored isolationism and was co-author of the Swing Johnson Act which made possible Boulder Dam
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Joliot Curie, Irene, 268
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Joyce, William (Lord Haw Haw) (1907-1946) During the first months of World War II, he broadcast from Germany to Great Britain trying to convince his audience that German aims were reasonable and that it was stupid to oppose them Captured soon after V E Day, he was tried in England for treason, and paid the penalty with his life on January 5 1946
Judge, court officer, 188
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K

Kern, Jerome (1885 1945), American composer He wrote lilting tuneful scores for a long list of musical plays that have become part of theatrical history among them Sally, Roberta and Showboat His most famous song Ol Man River, was in Showboat
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King Ernest Joseph (1878) commander in chief of the United States Fleet from December, 1941, to December 1945 Fleet Admiral King was senior member of the Army and Navy Joint Board of Strategy and a member of the Combined Chiefs of Staff of the United States and Great Britain A submarine expert and an aviator he was previously chief of the Navy Board of Aeronautics On his retirement in December, 1945 he was presented with the Navy Gold Star in lieu of a third Distinguished Service Medal for his 'foresight' as Chief of Naval Operations
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Lang Cosmo Gordon Lord (1864 1945) English churchman He was Archbishop of York from 1909 to 1928 and Archbishop of Canterbury and Primate of All England from 1928 to 1942 He was outspoken in the cause of justice and worked to bring about a greater unity among the various Christian churches
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Lloyd George David Earl of Dwyfor (1863 1945) British statesman born in Manchester England though his father came from Wales He was prime minister of Britain during and after World War I and was one of the Big Four who drafted the Versailles Treaty He was often called the man who won the last war Born into poverty he suffered grave hardships in his youth For fifty four years he sat in the House of Commons as Liberal member for Caernarvon Wales His earldom came in January 1945 only two months before his death
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M

MacArthur, Douglas (1880), commanding general of the United States forces occupying Japan and under Allied authority in charge of the reconstruction of the Japanese government industry and so on Under him Japan is being disarmed and various political reforms have been instituted In command in the Philippines in December, 1941 he was ordered to leave by President Roosevelt in March, 1942 Thereafter he halted the Japanese attempt to invade Australia and became supreme commander of all the Allied forces in the southwest Pacific He served in the first World War, and spent many years in the Philippines He has the five star rank of General of the Army *See also* 28
McCain John Sidney (1884 1945) American naval officer who was in command of the famous Carrier Task Force of the Third Fleet He helped to prepare the way for the Peleliu action gave air cover for the invasion of Leyte and helped to win the second Battle of the Philippine Sea An Annapolis graduate he served in World War I and in December, 1941, was in charge of the Naval Air Station at San Diego
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McCormack John (1884 1945) Irish tenor Born in County Athlone Ireland of poor parents he won world wide fame in opera and as a singer of ballads He first came to the United States in 1909 and became a citizen in 1919 But the last years of his life were spent near Dublin
McNab Archibald (1864 1945) Canadian political leader Born in Glengarry Ontario he went to the West to farm at the age of 18 settling first in Manitoba and then in Saskatchewan He served the latter province as lieutenant governor for 9 years
McNaughton Andrew G (1887) Canadian army officer Until late in 1943 when illness forced him to retire he was in command of the Canadian Army overseas, with headquarters in London He served through World War I and later became director of military training and deputy chief of the Canadian General Staff
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Marshall George Catlett (1880) American army officer From September 1939 until November 1945 he was chief of staff and the highest ranking general of the United States Army On his retirement President Truman appointed Marshall his special envoy to China with the rank of ambassador During the war he was responsible for the development of military plans and for carrying out strategic plans in conjunction with the Naval Staff and Allied Staffs
Mascagni Pietro (1864 1945) Italian composer His best known work is the opera Cavalleria Rusticana which brought him fame overnight in 1890 He wrote a number of other but less successful operas and was very popular in Italy
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Montgomery Sir Bernard (1887) commanding general of the British forces occupying Germany He led the famous British Eighth Army which in 1943 drove the German forces under Rommel from El Alamein in Egypt to Tunis and bore the brunt of the Tunisian and Sicilian campaigns
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Mountbatten Louis Lord (1900-) British admiral and supreme Allied commander in southeast Asia from August 1943 in charge of land sea and air forces In December 1945 he held a conference in Singapore on the problems of the Netherlands Indies and French Indo China where the natives are demanding greater rights if not outright independence He entered the Royal Navy in 1913 and made a brilliant record in World War II In 1942 he was chief of Combined Operations (the Commandos)
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Mussolini Benito (1883 1945), Italian dictator He organized the Fascist party in 1919 and in 1922 won complete power in Italy In June 1940 when it seemed that Hitler could not be stopped Mussolini brought Italy into the war on Germany s side Two years later he was forced to resign as premier even as the Allies were beginning the invasion of Italy When the Nazis were finally pushed out of northern Italy Italian Partisans (anti Fascists) executed him and his companions *See also* 119

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Nimitz, Chester William (1885) chief of Naval Operations the highest rank ing admiral in the Navy He was promoted to this rank in December 1945 For the four previous years he was commander in chief of the United States Pacific Fleet, with headquarters in Hawaii, and thus had direction of all naval action against the Japanese
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Panama in 1945 Panama was represented at the San Francisco Conference in March, in May, women voted for the first time in Panama's history, Enrique A Jimenez became provisional president of Panama, June 15, Florencio H Arosemena former president of Panama died August 30, the United States Navy completed the great fuel pipe line across the Isthmus of Panama on September 6
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Patch Alexander M , Jr (1889 1945), commanding general of the U S Army forces that won Guadalcanal He led the Seventh Army to victory in Europe Son of a general he was born at Fort Huachuca Arizona and graduated from West Point During World War I he saw service in France
Patton George Smith, Jr (1885 1945), American general in command of the Third Army, which spearheaded the great drive across western Europe in the last year of World War II He had won victories previously in North Africa and Sicily He was an audacious forceful leader with a swashbuckling colorful personality Death came as the result of an automobile accident, and he was buried in the Third Army cemetery at Hamm, Luxemburg
Pearkes, George R (1888), Canadian army officer who was in command of Canada s Pacific Coast Defense He acted in conjunction with the United States forces in the recapture of the Aleutian Islands from the Japanese late in 1943 In France with the Canadian Expeditionary Force in World War I he won the Victoria Cross For a time he was a member of the Canadian Northwest Mounted Police
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Pétain Henri Philippe (1856) head of the Vichy Government which collaborated with the Germans in the occupation of France On August 15 1945 a Paris jury found him guilty of intelligence with the enemy and returned a verdict of death General de Gaulle commuted the death sentence to life imprisonment Petain achieved fame in World War I particularly in the siege of Verdun and had a long career in the French Army See also 123 24
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Pyle Ernest Taylor (Ernie) (1900 45) American war correspondent He became a beloved figure for his simple homely accounts of the men in the foxholes of World War II where he lived with them He was born near Dana Indiana and was a newspaper man all his life He was killed by a Japanese bullet on Ie Shima a tiny island off Okinawa

Q

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Quisling Vidkun (1887 1945) leader of the nazi sympathizers in Norway who collaborated with the German occupation forces His name has entered the language as a synonym for traitor A Norwegian he yet helped to prepare the way for the German invasion of his country In October 1945 he was executed by a firing squad in Oslo for high treason
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Raeder, Erich (1876) German naval officer who was in command of the German Navy and later War Fleet Admiral Inspector When the Nazis came to power he joined them and worked hard to rebuild German naval power for which Hitler rewarded him with the high command At the end of 1945 he

Raeder Erich (*continued*)
was on trial before the international tribunal in Nuremberg
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Ramsay Bertram Home Sir (1883 1945) British admiral who served as naval deputy of General Eisenhower It was Admiral Ramsay's ships which saved the British Army at Dunkirk and four years later he directed naval operations in the Allied invasion of Normandy He was knighted for his services at Dunkirk His brilliant career in the Royal Navy began in 1898—and ended as the result of a fatal plane crash
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Riddell William Renwick (1852 1945) Canadian jurist From 1920 until his death he was senior justice of the Court of Appeal Ontario During the early part of his career he was a professor of mathematics but he was called to the bar by the Lawyers Society of Upper Canada with gold medal in 1883
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Roosevelt Franklin Delano (1882 1945) 32nd president of the United States 1933 45 These were dramatic years in the world's history covering the depression and World War II and Roosevelt became one of the world's leading statesmen He was born at Hyde Park New York and educated at Groton and Harvard and first entered politics in
Roosevelt Franklin Delano (*continued*)
1910 In spite of the crippling results of an attack of infantile paralysis in 1921 he later was elected governor of New York twice and president of his country four times *See also* 320 and The Book of Knowledge Annual 1945
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Salten Felix (1870 1945) Austrian writer creator of Bambi the lovely story for children which was later made into a Disney motion picture He was forced to flee when Hitler invaded Austria and spent his last years in Switzerland Other works for children are Perri The Hound of Florence and Herr Wenzel auf Rehberg
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Shaposhnikov, Boris Mikhailovich (1882 1945), Russian marshal He was chief of the Supreme Soviet Military Academy, and served as chief of the general staff during the first year of the German invasion of Russia Ill health forced him to retire in the fall of 1942
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Snyder, John Wesley (1896-), director of the Office of War Mobilization and Reconversion This is one of the most important positions in the Truman Administration as the office has the tremendous job of turning industrial efforts into peacetime channels He is not a newcomer to government, but has served with the Defense Plant Corporation and the Reconstruction Finance Corporation His home is in St Louis
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Spaatz Carl (1891) American army officer who was in command of the United States Army Air Forces in the Mediterranean area under Air Marshal Tedder In 1944 Spaatz was appointed commander in chief of the United States bombing forces against Germany In December, 1945 he was presented with the 1945 Robert J Collier aviation trophy annual award of the National Aeronautic Association for demonstrating the air power concept in the war in Europe
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Stark Harold Raynsford (1880) American admiral who commanded the United States naval forces in Europe His most important duty was to maintain close co-operation between the British and American naval departments Previously he had held the important post of Chief of Naval Operations He has had a long career in the Navy and during World War I was a member of Admiral Sims's staff Admiral Stark retired in July, 1945
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Stettinius, Edward Reilly, Jr (1900-), United States representative with rank of ambassador, to Security Council and principal representative to the United Nations Organization General Assembly, which was to meet in London in January, 1946 From November, 1944 to June 1945 he served as Secretary of State, and in the spring of 1945 was temporary head of the San Francisco Conference He entered government service in 1940, from the post of chairman of the board of the United States Steel Corporation
Stilwell Joseph W (1883-), American army officer From 1942 until the end of 1944 he was commanding general of the United States forces in China Burma and India and a member of the staff of Chiang Kai shek He had served in China previously and learned the Chinese language In 1945 he was made

Stilwell, Joseph W (*continued*)
chief of the Army Ground Forces and in November was named president of an Army board to study equipment needed by the post war Ground Forces
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Szold Henrietta (1860 1945) American Jewish women's leader founder of Hadassah the women's Zionist organization in the United States She served as editor of a number of Jewish publications and was an outstanding leader in the work for Palestine where she lived during her last years

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Timoshenko Semyon (1895), commanding general with the rank of marshal of the general defense of Stalingrad and the campaigns that crushed the German Army and recaptured Rostov He is one of the leading Russian strategists As a youth he was active in the Russian Revolution Earlier in World War II he directed the strategy in the Polish and Finnish campaigns and in 1941 held the Germans at Smolensk until preparations for the defense of Moscow were completed
Timoshenko Semyon (*continued*)
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Truman Harry S (1884) president of the United States In 1944 he was elected vice-president and became president in April 1945 succeeding Franklin Roosevelt Truman served as a Senator from his home state of Missouri from 1934 until his election as vice president He became widely known for the excellent results he achieved as chairman of the Senate War Investigating Committee which was formed to help put the production of war materials on a sound basis Though he was turned down by West Point because of defective eyesight he nevertheless served in France during World War I and came out with the rank of major From 1926 to 1934 he was presiding judge of Jackson County Missouri Court
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Van Anda, Carr V (1864 1945), American journalist He was most widely known as managing editor of the New York Times, a post he held for twenty one years from 1904 to 1925 A master in the gathering and presentation of news, he stood in the front rank of the working newspaper men of his time His special field was news of science, aviation and exploration
Van de Graaff generator, 269
Vandegrift, Alexander Archer (1887), commander, with the rank of lieutenant general, of the United States Marine Corps, which post he has held since 1943 He led the Marines who attacked and held Guadalcanal against powerful enemy forces in 1942 At Bougainville, in 1943, he commanded the First Marine Amphibious Corps He was born in Virginia, joined the Marines at an early age, and has seen service in Haiti, Nicaragua, Mexico, Cuba and China
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Voronov Nikolai, marshal of the Russian Army and chief of artillery With Marshal Zhukov he supervised the offensive to relieve Stalingrad and had a prominent part in the offensive which freed Rostov in the fall of 1942 The Russian Army is powerfully equipped with artillery, which is one of their most important arms
Voroshilov, Klementi (1881-), first marshal of the Union of Soviet Socialist Republics, who commanded the Leningrad sector, which underwent a long siege He is a member of the Council of Commissars and for a time was chairman of the Defense Committee One of the original supporters of Lenin and Stalin, he has held a number of important political and military posts
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Wainwright, Jonathan Mayhew (1883-), American army officer who commanded the American forces at Bataan and Corregidor in the Philippines, and was forced to surrender after all munitions and supplies had been exhausted For three years, until the defeat of Japan he was held prisoner, suffering severe hardships On his return to the United States he was made a full general and given the Congressional Medal of Honor for 'intrepid and determined leadership' He is the son and grandson of army officers, and had a notable career in World War I and in the Philippines
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Werfel Franz (1890 1945) writer born in Prague now the capital of Czechoslovakia He was most famous as the author of the novels The Song of Bernadette (made into a motion picture) and The Forty Days of Musa Dagh Fleeing the Nazis he came to the United States in 1940 and died in Hollywood
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Yamashita Tomoyuki commander of the Japanese armies that captured the Malay Peninsula and Singapore and then conquered the Philippines He was a violent pro German and acquired a notorious reputation for brutality In 1945 he was brought to trial for condoning atrocities by his troops in the Philippines and sentenced to be hanged His appeal to the Supreme Court to void the Manila trial and transfer case from the War Department to a United States court was still pending at the year's close but there was little likelihood that he would escape execution
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Yeremenko Andrei chief of the Russian forces that outflanked the Germans at Stalingrad and captured or destroyed twenty two German divisions A prize prisoner was the German commander Marshal von Paulus Yeremenko has a cold and bitter hatred of the Nazis who killed his wife and young son early in the war
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Zhukov Georgy (1894) commanding general with the rank of marshal of the Russian forces occupying Germany He participated in the formal surrender of Germany and signed for Russia During the war he was in command of the Moscow area and served as first vice-commissar for defense and as second in command under Stalin He entered the Russian Army as a private and rose rapidly He first became widely known for his defeat of the Japanese in the undeclared war in Mongolia in 1938 39
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